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The MONTHLY REVIEW

Published by the
American Electro-Platers' Society

Best Wishes
FOR A
Merry Christmas

DECEMBER . . 1935

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A SOCIETY FOR THE ADVANCEMENT OF THE SCIENCE OF ELECTRO-PLATING

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SAVE

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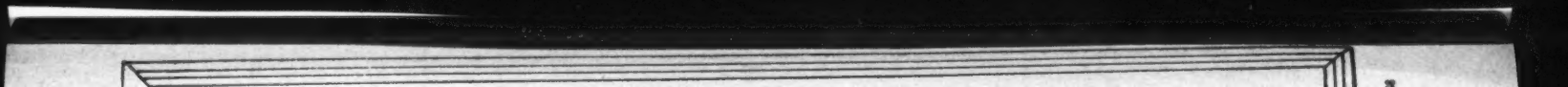


The MONTHLY REVIEW

Published by the
AMERICAN ELECTRO-PLATERS' SOCIETY

Publication and Editorial Office
90 Maynard St.
Springfield, Massachusetts

VOL. XXII DECEMBER 1935 NO. 12

Membership Drive Extended to January 31, 1936

Reports coming in from our Branch Societies indicate that our membership drive is most successful. Every member of the Supreme Society, every Branch Officer, and every Branch Member are all doing their utmost to contact and bring in every eligible member.

Our membership should be increased 50% at the minimum during this drive, this will mean that our MONTHLY REVIEW will have a larger mailing list and this more extensive reading audience will permit us to secure the very best technical and practical articles on electrodeposition for its pages. Our official publication must be kept in the same class with the finest technical journals in the electroplating and electrochemical industry. Increasing our membership will assist in accomplishing this ideal and it will sell electroplating to the manufacturer, the public and the technical engineer. A larger mailing list will insure a substantial return from advertising, as advertisers must be assured of a large circulation before signing.

Because of the urgent request of several Branches whose committees are just beginning to get the spirit of our drive, it has been decided to extend this membership drive until the end of January, 1936. By doing this, it will permit every branch to get its committee to function 100%, permit publication of the applications in our REVIEW, and an opportunity for a vote on these. It will give us an accurate count on the new members by the increased payment of per capita tax for the third quarter, payable February 15, 1936.

I wish to express my sincere thanks to every member of the society for the assistance and cooperation they have given the Supreme Society representatives of their branch who constitute the local committees for this drive. It is hoped that this enthusiasm will continue until the close of the drive, January 31, 1936.

T. F. SLATTERY.

The Sequel to One of Our Most Successful Conventions

The A. E. S. Twenty-Third Annual Convention, which was held in Bridgeport, Connecticut, June 10-13, 1935 was the first ever held and managed by the members of the Bridgeport Branch. It's outstanding success was noted on the editorial page of the Metal Industry, Vol. 33, No. 7, page 250, from which I quote, "It's praises cannot be sung in a few words, the activities, the innovations, the new records set were too numerous to be lumped together and covered by a phrase."

But, Bridgeport marches on, gives encouragement and financial support in the form of a donation from the proceeds of this convention to three of our major activities:

Research Fund	$300
Supreme Society	250
MONTHLY REVIEW	250
Total	$800

In behalf of past President Gilbertson; the Executive Board of his administration, and the present officers and members of the A. E. S., I wish to extend our most sincere gratitude to the Committee and members of the Bridgeport Branch. This generous and exemplary support by Bridgeport should be another stimulant to our entire membership to "put across" our society to every manufacturer and every electroplater in America.

T. F. SLATTERY.

1936 Convention

It is a trifle early to disclose the plans that are under way for the education and entertainment of our members when they arrive in Cleveland for our 1936 Convention.

We think it might be proper at this time to acquaint you with the splendid facilities that Cleveland enjoys for your comfort and entertainment. We hope that you may find time in a future meeting to read this letter to your brother members, and preserve for reference at some later date.

Cleveland has had valuable experience, gained thru years of serving large and small conventions, and its location makes it an ideal meeting place.

With half of the population of the United States and Canada living within an overnight's ride, maximum attendance at Cleveland Conventions is a regular report. Every means of transportation: air-water-motor-rail, are available to bring you to the city.

During the time we are holding our Convention, it will be particularly pleasant to make the trip by steamer and plane. This service synchronized with rail schedules from all important centers, makes a journey possible with a minimum of time and effort.

Cleveland's hotel accomodations for its convention visitors are splendid. Six hotels alone have 4,500 rooms, each with private bath. Designed for conventions, modern and well equipped, these hotels assist in making Cleveland Conventions successful. Of course your committee has selected a hotel which is best adapted to handle the combined convention and exhibition in a single unit.

All public space is accessible without recourse to elevators and attendant congestion.

Cleveland offers a great variety of recreation. Of course while the program will occupy our members every minute, some may care to arrive in Cleveland early enough to avail themselves of Cleveland's parks, baseball, summer resorts, etc.

Playhouse Square in Cleveland presents the highest grade of entertainment and is only three blocks from the Carter Hotel.

One of the most famous shopping streets in the world is Euclid Avenue, with its array of fine shops. The attractive and artistic window displays and interior decorations are always of interest.

Again, our Hotel is only one block removed from this district and still far enough from the noise belt to insure you an undisturbed night's rest.

Cleveland's wide streets and broad sidewalks have been an important factor in its success as a shopping center. No large city in the United States is better equipped to handle large crowds of shoppers.

The shops themselves have wide aisles, easily accessible stairways, elevators, esculators, all of which facilitate shopping.

To enable their clientele to secure the latest style originations, all of the larger stores maintain buyers in the foreign centers of fashion.

Cleveland's many other attractions include beautiful residential sections, great universities and schools, interesting museums and historical points of interest.

Above all, visitors to Cleveland find a spirit of friendliness and they carry away pleasant memories and a desire to return.

Are you going to be among those coming to Cleveland in June, 1936?

Make this part of your New Year's resolution; "I am going to attend the Cleveland Convention."

I'll be seein' you,

E. STEEN THOMPSON.

Publicity Committee.

Optimum Metal *Concentration of* Nickel *Solutions*

By D. A. COTTON

Read at A. E. S. Convention 1935

WHAT is the optimum metal concentration for a nickel bath? When I was asked to prepare a paper on this subject, it looked like a big undertaking and now after having spent most of my spare time on it for the past three months, it looks still bigger.

Trying to decide which is the best concentration for a nickel solution is about as difficult as answering the question, "What is the best type of woman to pick out for a wife?" If we all had exactly the same ideas on this subject, we would be in an awful mess.

When starting on a problem like this, obviously we must decide what we require of a good plating bath, such as:

1. Efficiency, both as to anode corrosion and deposition of metal. This includes economy of operation.
2. Good quality of plate.
3. Good throwing power.

For a starting point I decided to use a solution of the general type recommended by Dr. Watts and adopted the following formula: 6 oz. per gal. nickel, 3 oz. nickel chloride and 4 oz. boric acid, holding the latter two constant and varying total nickel by use of single nickel sulphate. The pH was held at the value as obtained from the makeup of the solution.

Total nickel was varied in steps of approximately 2 oz. per gal. beginning with 2 oz. and ending with 12 oz.

It was expected that somewhere along the line, it might be necessary to increase the chloride content when certain symptoms appeared, such as excessive ano e polarization or lowered anode corrosion.

The plating tank was a hard rubber box holding about 1¼ gallons of solution and so made that it could be used as a Haring cell to measure anode and cathode polarization and resistance of the solution. The distance between anode and cathode while determining cathode efficiencies was 6". The anode was of 99.5% nickel having an area approximately equal to that of the area plated on the cathode. The cathodes were of sheet brass

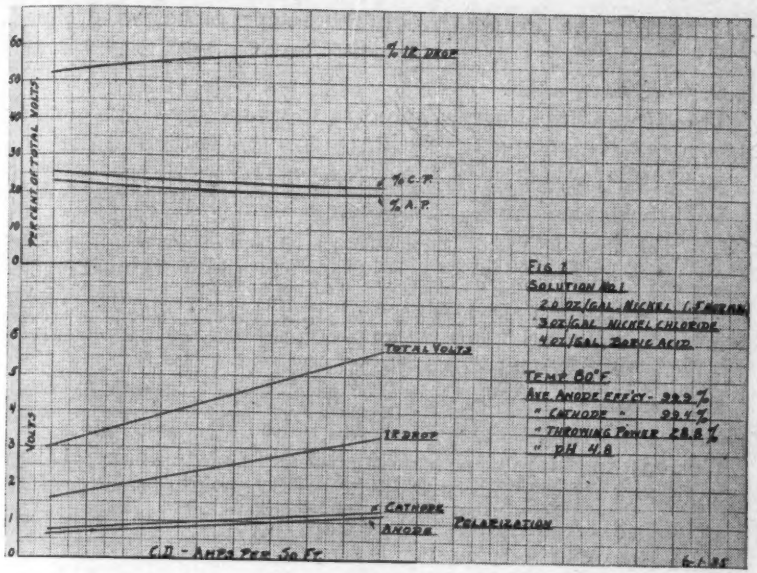


FIG. 1
SOLUTION NO. 1
2.0 OZ/GAL. NICKEL AMMONIUM SULPHATE
3 OZ/GAL. NICKEL CHLORIDE
4 OZ/GAL. BORIC ACID.
TEMP. 60°F.
AVE. ANODE EFF'CY - 99.2 %
" CATHODE " 99.4 %
" THROWING POWER 28.8 %
" pH 4.8

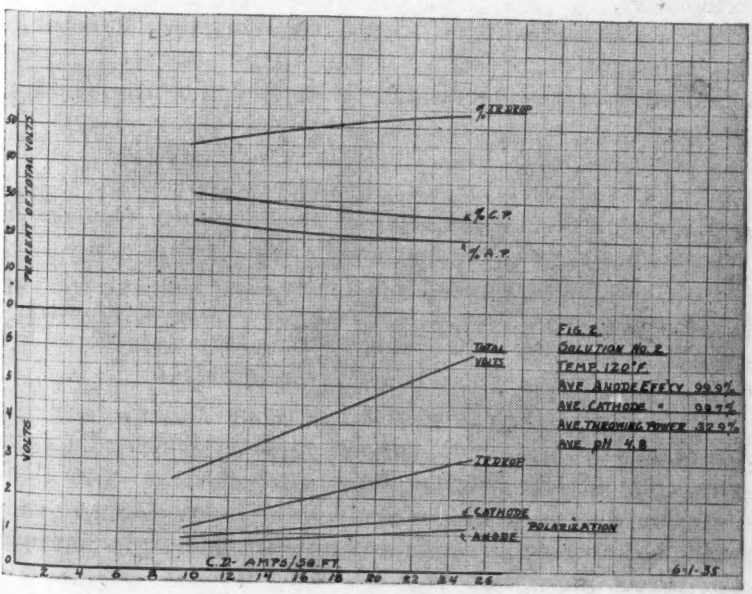


FIG. 2.
SOLUTION NO. 2
TEMP. 120°F.
AVE. ANODE EFF'CY 99.9%
AVE. CATHODE " 99.7%
AVE. THROWING POWER 32.9%
AVE. pH 4.8

.018″ x 5″ x 2.5″ of which only 8.9 square inches were plated. The cathodes were held in a bakelite frame so that the edges and back were not plated.

Throwing power was measured in the same tank by changing the position of the anode and putting in two cathodes, the ratio of distances between cathodes and anode being 3 to 1.

Each bath was run at two different temperatures, 80° F and 120° F, the tank being kept in a water bath to hold the temperature.

Cathode efficiency was determined over the working range of current density for each solution, hot and cold, varying current from a low value up to one which produced bad plate as shown by burned edges, pitted or peeled surfaces.

All specimen cathodes were polished on one side, weighed previously to plating, then weighed and buffed after plating.

Current and time were so adjusted as to plate about 312 mg. of nickel on each. This is equivalent to .00024″ plate thickness.

pH was determined electrometrically at the beginning and end of each run.

Voltmeters and ammeters were calibrated several times during the tests by means of Weston primary standard meters. When it was deemed desirable, readings were checked against a copper coulometer.

Anode efficiencies were checked by analyzing the solution at the beginning and end of each run, adding to the latter the "dragout" obtained from the cathodes and gauzes used in measuring polarization.

The nickel gauzes used in the Haring cell were plated in each new nickel solution before using them for measurements.

Each time a sample of solution was withdrawn to make pH measurements, an equal amount of original solution was added to the tank to compensate for it.

Throwing power was determined while varying the current density through the working range of the solution, the upper limit being that which produced bad deposits on the near plate.

After running the cathode efficiencies and throwing power at the normal pH of the bath, curves were taken showing the variation of cathode efficiency and throwing power with varying pH.

In studying these various plating solutions, it seemed that it would be important to carefully observe the factors that influence the current and voltage relations.

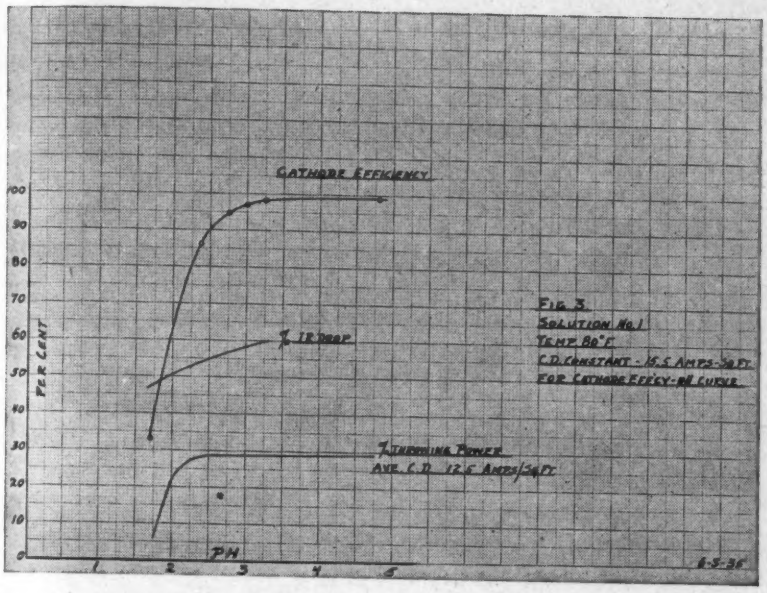


FIG. 3.
SOLUTION No. 1
TEMP. 80°F.
C.D. CONSTANT - 15.5 AMPS-SQ.FT.
FOR CATHODE EFFICY-PH CURVE

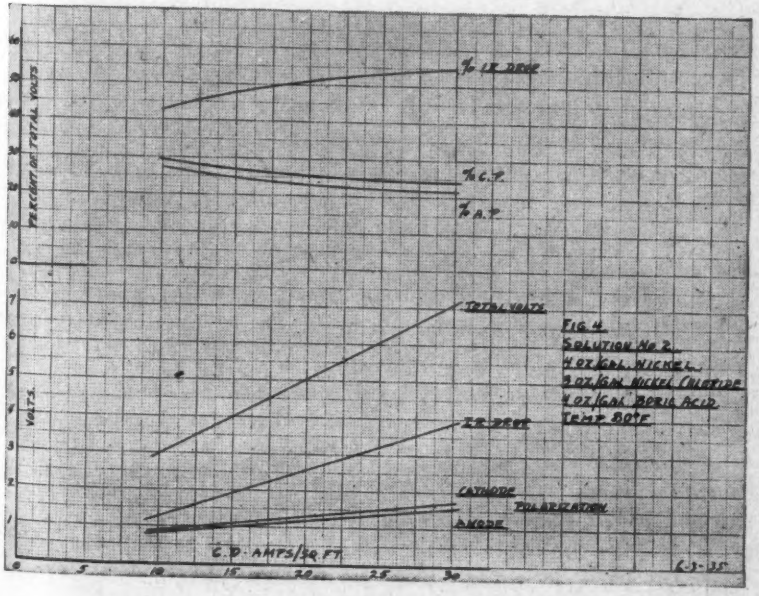


FIG. 4.
SOLUTION No. 2.
4 OZ./GAL. NICKEL
3 OZ./GAL. NICKEL CHLORIDE
4 OZ./GAL. BORIC ACID
TEMP. 80°F.

As you all know, the voltage applied to a plating bath has three components; one which overcomes the internal resistance of the solution to which I shall refer hereafter as IR drop and one each to overcome the counter electromotive force set up at the anode and the cathode. The latter two I shall call anode and cathode polarization and sometimes abbreviate it to A. P. and C. P.

The voltage applied to a bath is important from a dollar and cents standpoint for while it is the ampere-hour that puts on the plate, we pay for the watt-hour or volt-ampere-hour. In other words, the higher the voltage required to produce a given current, the higher the cost of operation.

Obviously, then the first means of reducing voltage will be to reduce resistance of solutions for the IR drop component represents about 50% of the total voltage, varying from 40 to 60% in the solutions tested. Two ways to reduce resistance are (1) to increase concentration of solutions and (2) to heat them.

Referring to Fig. 23, page 25, we see that the resistivity of the 4 oz. solution is 24 ohm-cm compared with 34 ohm-cm for the 2 oz. solution; a decrease of about 30%. When the 4 oz. is heated to 120°F from 80°F we get a still further reduction of 25%.

As we continue to increase concentration the decrease in resistivity becomes less and less so that in that respect alone, the 12 oz. solution does not have much advantage over the 10 oz.

Although total voltage and IR drop decrease greatly with increase in concentration and temperature, the percentage of IR drop remains about the same at 50%.

The remaining 50% of total voltage is about equally divided between cathode and anode polarization, the latter as a rule being somewhat below the cathode polarization.

The % of IR drop increases as current density rises and anode and cathode polarization decrease. In the solutions tested there were some exceptions which will be discussed later.

For each solution, the total volts, IR drop, cathode and anode polarization as well as the percentage of the latter three to total volts were plotted against current density.

Fig. 1, page 7, shows these curves for the 2 oz. solution at 80°F. Fig. 2, page 7, for the same solution at 120°F.

Note that the total voltage at 15 amps. per sq. ft. was 5.1 for the cold solution and only 3.75 for the hot one.

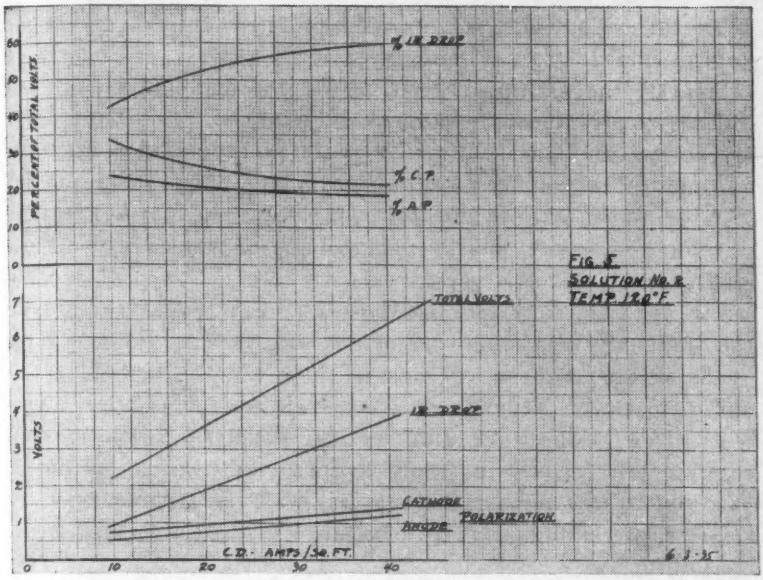


FIG. 6
SOLUTION NO. 2
TEMP. 120°F

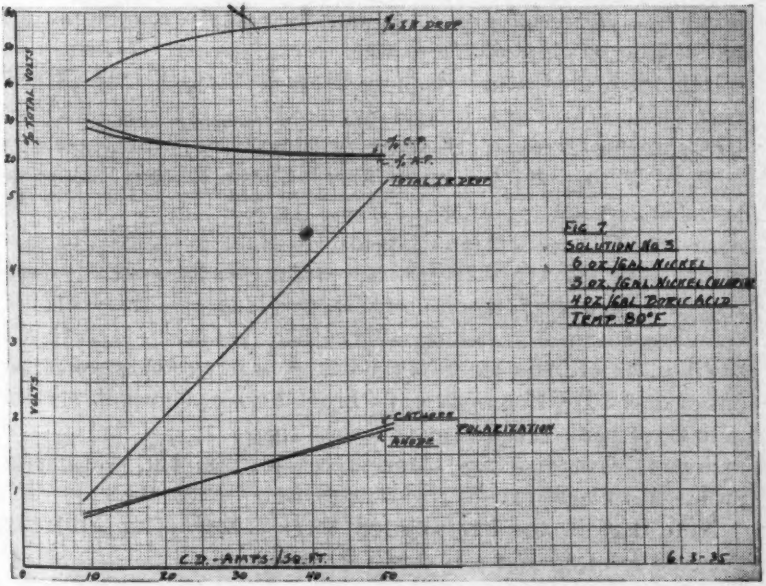


FIG. 7
SOLUTION NO. 3
6 OZ. / GAL. NICKEL
3 OZ. / GAL. NICKEL CHLORIDE
4 OZ. / GAL. BORIC ACID
TEMP. 80°F

Note also what I call the normal relations of cathode and anode polarization, the former being slightly higher.

Heating the solution lowered all the voltage components but did not greatly affect the percentage.

The 4 oz. and 6 oz. solutions show the same general characteristics as the 2 oz. but the 8 oz. in Fig. 10, page 13, shows a reversal of A. P. and C. P. In Fig. 11, page 15, we see that heating the solution very nearly brought them back to what I call normal relations.

Fig. 14, page 17, shows the 10 oz. cold in which you may note the similarity between these curves and those of the hot 8 oz. which we just examined.

Fig. 15, page 17, shows the 10 oz. solution.

In Fig. 17, page 19, we have the curves for the 12 oz. solution cold, and we see that not only is the anode polarization out of position but its value increases rapidly with rising current density and the percentage of A. P. instead of falling with rising C. D. rises abruptly.

Fig. 18, page 21, shows that heating the solution particularly corrected this tendency, but still left A. P. higher.

Fig. 19, page 21, shows another cold 12 oz. solution made up with 6 oz. per gal. of nickel chloride instead of 3 oz. as in all previous solutions. You note that the same tendency prevails but to a lesser degree, and finally, in Fig. 20, page 23, when the solution is heated, the C. P. and A. P. resume their normal position. Please note that it is merely a convention of my own when I call this position of C. P. above A. P. normal. But whenever a reversal of this position takes place, it seems to have some abnormal effect in the plating, as I shall point out later.

In Fig. 24, page 27, we have the IR drops all plotted to show comparison between the various solutions. These are all consistent and we will not dwell on them.

In Fig. 26, Page 27, we have the cathode polarization, both cold and hot. Here you see that the cold 8 oz. solution is somewhat out of line. Heating apparently brought it into normal relations with the others. Note the position of the 12 oz.-3 nickel chloride and the 12 oz.-6 nickel chloride, when cold, and the change produced by heating.

Note that in the hot solution there is very little difference between 8, 10, 12-3 and 12-6 in respect of cathode polarization.

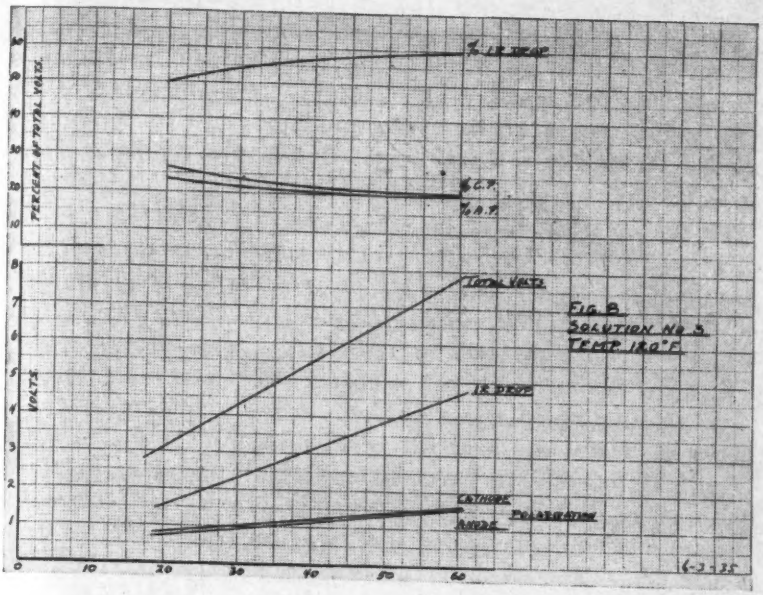


FIG. 8.
SOLUTION No. 3
TEMP. 120°F.

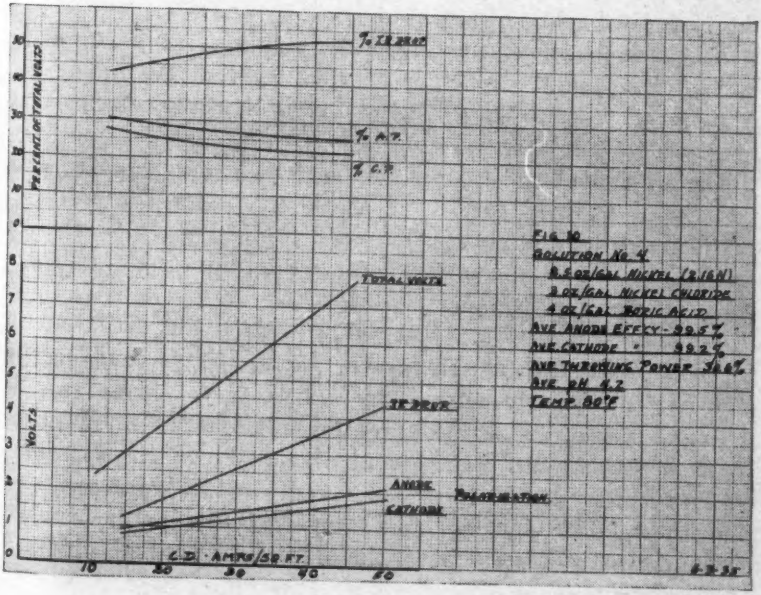


FIG. 10
SOLUTION No. 4
8.5 OZ/GAL NICKEL (2.16 N)
3 OZ/GAL NICKEL CHLORIDE
4 OZ/GAL BORIC ACID
AVE. ANODE EFFCY - 99.5%
AVE. CATHODE " - 99.2%
AVE. THROWING POWER 76.6%
AVE. pH 4.2
TEMP. 80°F

Now refer to Fig. 27, page 29, which shows the anode polarizations. Note that the cold 8 oz. solution is out of position and that 12-3 has run amuck. Then see how heating them made them line up pretty well. The 12-6 is apparently a little better than the 8 oz. with regard to anode polarization, and the 10 oz. seems to stand out as somewhat better than the rest.

I have no explanation for the apparent inconsistency of the cold 8 oz. solution. I made up a new solution and got the same results. Probably if the nickel chloride content had been increased it would have corrected this trouble. Yet why was the cold 10 oz. solution apparently O. K?

I stated earlier that it was expected somewhere along the line of increasing metal concentration, to see symptoms such as increased anode polarization that would call for more chlorides. Obviously that was very plainly indicated in the 12 oz. solution, and perhaps the first symptoms began to show up in the 8 oz. one.

Examination of the plated specimens confirmed some of these conclusions. For instance, the specimens plated in the 8 oz. cold bath were very poor, whereas those from the hot 8 oz. were very good, and the cold 10 oz. samples were fairly good, much better than the 8 oz. cold. The cold 12-3 solution samples were not so good nor were the hot samples. But the samples plated in the 12-6, both cold and hot, were good.

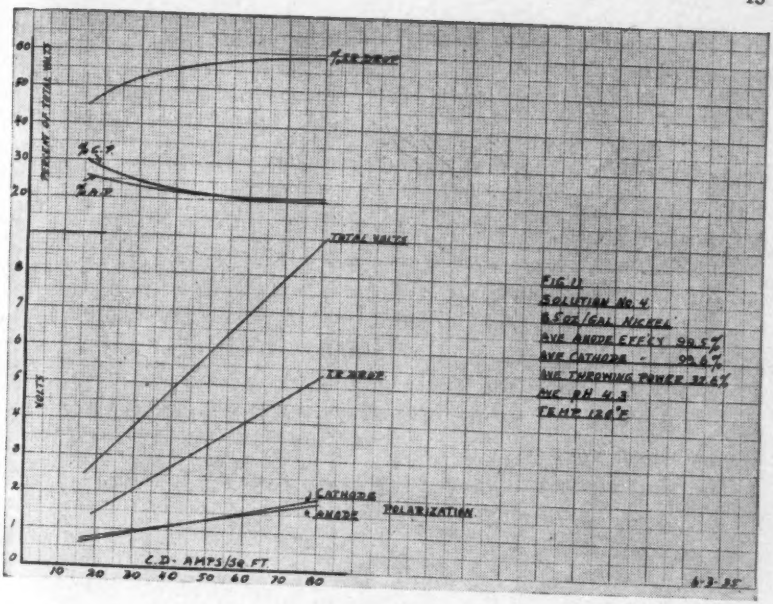
The cathode efficiencies of all the solutions were uniformly high, from 97 plus per cent to 99 plus per cent, seemingly not being greatly affected by changing current densities or heating of solutions.

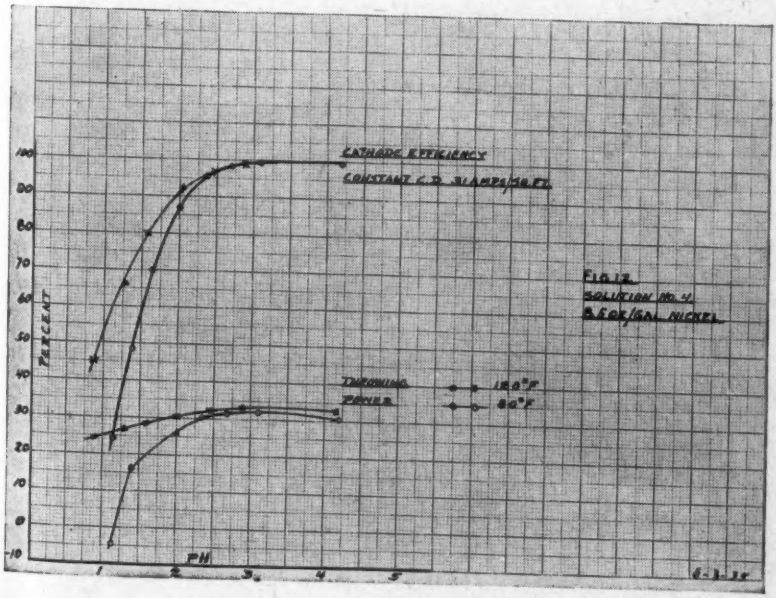
The anode efficiencies were also very high, ranging from 98.5 per cent to 99.5 per cent.

Judging from the curves, it would probably be desirable to increase the chloride content of the 8 oz. solution and of those above it, for continuous operation.

As to throwing power, it also did not vary to any great extent, say from about 25% to 33%. On the average, it was slightly higher in the hot solutions.

In making a study of various plating solutions it seemed desirable to find what effect the pH of a bath would have on its cathode efficiency and throwing power. So with each of these solutions after the cathode efficiency and throwing power had been taken at the normal pH of the bath, the pH was lowered step by step


% EFFICIENCY
% C.E.
% T.P.
TOTAL VOLTS
I.R. DROP
CATHODE
ANODE
POLARIZATION
VOLTS
PERCENT OF TOTAL VOLTS
C.D. - AMPS/SQ FT.
FIG. 11
SOLUTION NO. 4
8.5 OZ/GAL NICKEL
AVE ANODE EFFCY 98.5%
AVE CATHODE - 98.6%
AVE THROWING POWER 32.6%
AVE. PH 4.3
TEMP 120°F
6-3-35


CATHODE EFFICIENCY
CONSTANT C.D. 31 AMPS/SQ FT.
THROWING POWER
120°F
80°F
PERCENT
PH
FIG 12.
SOLUTION NO. 4
8.5 OZ/GAL NICKEL
6-3-35

and these values were again determined holding a constant current density.

Fig. 3, page 9, shows the curves for the 2 oz. solution.

Fig. 12, page 15, shows such curves for the 8 oz. solution. It is interesting to note that cathode efficiency maintains its high value down to about 3 pH.

Fig. 16, page 19, shows the curves of the 10 oz. solution.

Fig. 21, page 23, shows the effect of doubling the chloride content of the 12 oz. solution.

Fig. 22, page 25, shows a composite picture. The shaded area covers the whole range of solutions containing 3 oz. nickel chloride. Note that the 2 oz. curve begins to droop at about pH 3.25 and drops off more abruptly. As the concentration increases the efficiency holds up higher for lower pH's.

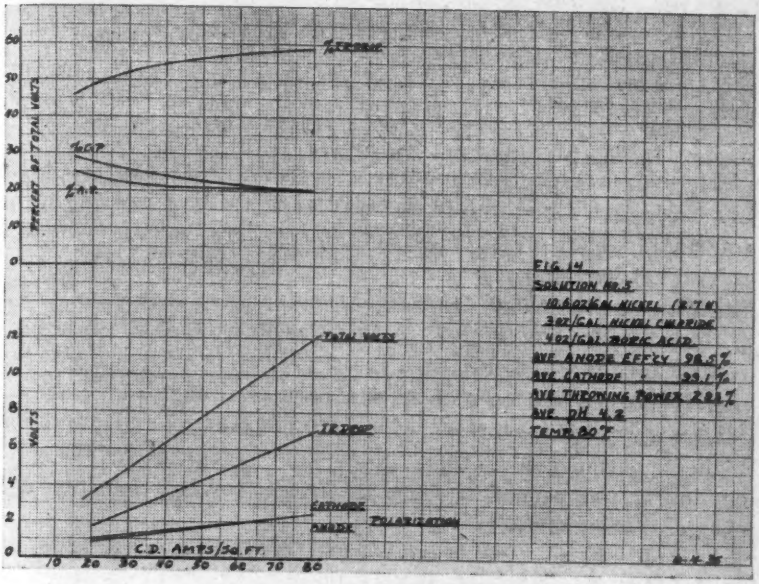
The next curve out from the shaded area shows the effect of adding the 6 oz. of nickel chloride to the 12 oz. solution and the next one out shows the effect of running the 8 oz. solution hot (120°F.). Probably all these cathode efficiency-pH curves should have been run hot as well as at 80°F.

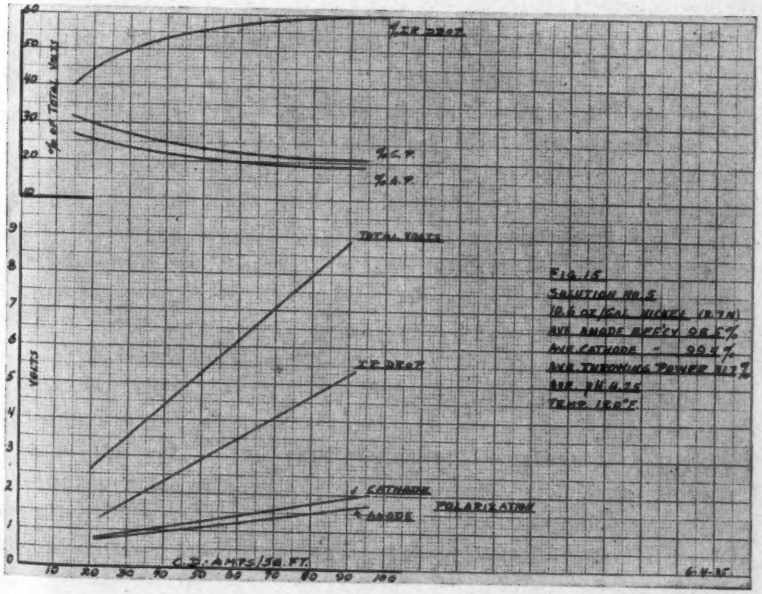
That emphasizes the mistake of jumping at conclusions. Inasmuch as the cathode efficiencies at normal pH had been practically the same whether cold or warm, I assumed that the same would be true at the lower pH's, and so took them all only at 80°F. However, the last thing I did was to make up another 8 oz. solution and run this curve hot. The hot solutions apparently maintain a considerably higher efficiency at lower pH than the cold ones.

In the 2 oz. solution the cathode and anode polarization were practically constant as pH decreased, but percentage IR drop decreased and percentage C. P. and percentage A. P. both increased. In all the other solutions, anode and cathode polarization decreased slightly with lowered pH, but percentage of IR drop, A. P. and C. P., remained practically constant.

The following table summarizes some of the average values obtained in the tests made:

C. D. Range	2 oz.	4 oz.	6 oz.	8 oz.	10 oz.	12 oz.
Cold	8-13	10-25	15-40	15-40	15-50	15-45
Hot	10-20	15-30	20-65	15-80	15-90	15-90
Voltage Range						
Cold	3-4.5	3-6	3-7	3-7	3-8	3-7
Hot	3-5	3-5	3-8.5	3-9	2-9	2-9


% I.R. DROP
% C.P.
% A.P.
PERCENT OF TOTAL VOLTS
TOTAL VOLTS
I.R. DROP
CATHODE
ANODE
POLARIZATION
VOLTS
C.D. AMPS/SQ. FT.
10 20 30 40 50 60 70 80
FIG. 14
SOLUTION NO. 5
10.6 OZ/GAL NICKEL (2.7 N)
3 OZ/GAL NICKEL CHLORIDE
4 OZ/GAL BORIC ACID
AVE. ANODE EFF'CY 98.5%
AVE. CATHODE " 99.1%
AVE. THROWING POWER 201%
AVE. pH 4.2
TEMP. 80°F


% I.R. DROP
% C.P.
% A.P.
% OF TOTAL VOLTS
TOTAL VOLTS
I.R. DROP
CATHODE
ANODE
POLARIZATION
VOLTS
C.D. AMPS/SQ. FT.
10 20 30 40 50 60 70 80 90 100
FIG. 15
SOLUTION NO. 5
10.6 OZ/GAL NICKEL (2.7 N)
AVE. ANODE EFF'CY 98.5%
AVE. CATHODE " 99.1%
AVE. THROWING POWER 217%
AVE. pH 4.25
TEMP. 120°F

Average Cathode Efficiency	99.5%	98.8%	98.6%	99.4%	99.3%	99.5%
Average Anode Efficiency	99.9%	99.0%	99.3%	99.5%	98.5%	99.7%
Average Throwing Power	31%	25%	30.7%	31.6%	30.5%	29.6%

These data are given you merely as results of tests I made in an effort to start something in the way of a study of nickel plating solutions. They are intended only to be comparative.

You can see that if you start in varying other constituents of the bath, such as nickel chloride, you could go on indefinitely.

Returning to the original question as to what is the best concentration for a nickel bath, I make no claims or assertions, but merely hazard the opinion of a laboratory man that I see no reason why nickel solutions, especially hot ones, cannot be run at higher concentrations than those now being used. This, of course, would permit the use of higher current densities and shorter plating time.

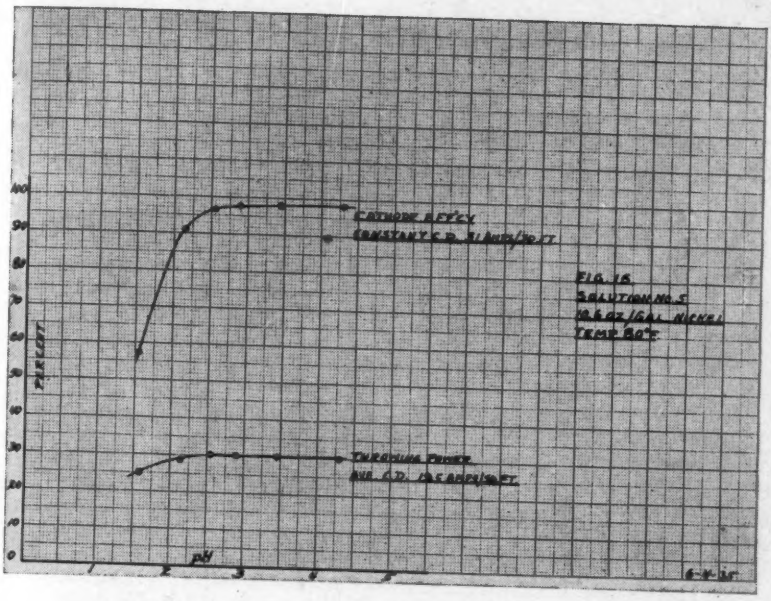
I would like to, and probably shall, hear some of the opinions of men actually working in these fields.

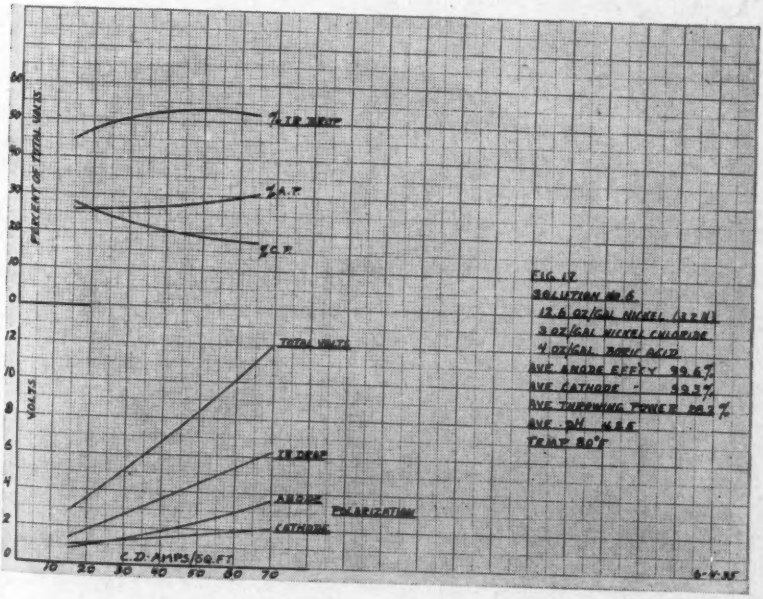
I wish to acknowledge the cooperation of A. W. Phelps, who made it possible for me to do this work, the assistance of W. A. Fletcher, who made the slides, and the advice of G. B. Hogaboom. (Applause).

DELEGATE PROCTER: Dr. Cotton made no mention of the anode that he used in the experiments.

DR. COTTON: I said I used an anode of 99.5 per cent nickel.

MR. HOGABOOM: I think this is one of the finest papers that has been presented on nickel plating, and I think everyone will agree with me that the magnitude of this work has been wonderful. To my knowledge it is the first real study of the nickel solution giving such valuable data. It has been generally the rule to just guess at what would happen, increasing the metal concentration, increasing chloride concentration, boric acid or temperature, without knowing anything about the exact effect. We have seen something now that will give us a basis upon which to build some real work, and I think that the Society and the whole plating industry is greatly indebted to Dr. Cotton for such exacting work. As Chairman of the Committee, I knew whom to ask to get such a paper, and I think that we are all greatly indebted to Dr. Cotton. When I tell you that there were over 8,000


CATHODE EFF'CY
(CONSTANT C.D. 30 AMPS/SQ FT
THROWING POWER
AVE. C.D. 15.5 AMPS/SQ FT
PERCENT
pH
FIG. 16
SOLUTION NO. 5
12.5 OZ/GAL NICKEL
TEMP 80°F


% I.R. DROP
% A.P.
% C.P.
PERCENT OF TOTAL VOLTS
TOTAL VOLTS
I.R. DROP
ANODE
CATHODE
POLARIZATION
VOLTS
C.D. AMPS/SQ FT
FIG. 17
SOLUTION NO. 6
12.5 OZ/GAL NICKEL (32 Ni)
3 OZ/GAL NICKEL CHLORIDE
4 OZ/GAL BORIC ACID
AVE ANODE EFF'CY 99.6%
AVE CATHODE " 93.3%
AVE THROWING POWER 90.2%
AVE pH 4.8
TEMP 80°F

runs made and some 400 solutions, if that is correct, as I believe it is, you can see the magnitude of this work to obtain these curves. Such work should not go by without being highly commended. (Applause).

DR. COTTON: I should like to correct that statement. It may have seemed that there were that many, but there were really about 500 specimens plated, and six or seven thousand observations and calculations made on them.

CHAIRMAN SLATTERY: Would you mind telling what these samples that I am passing out are?

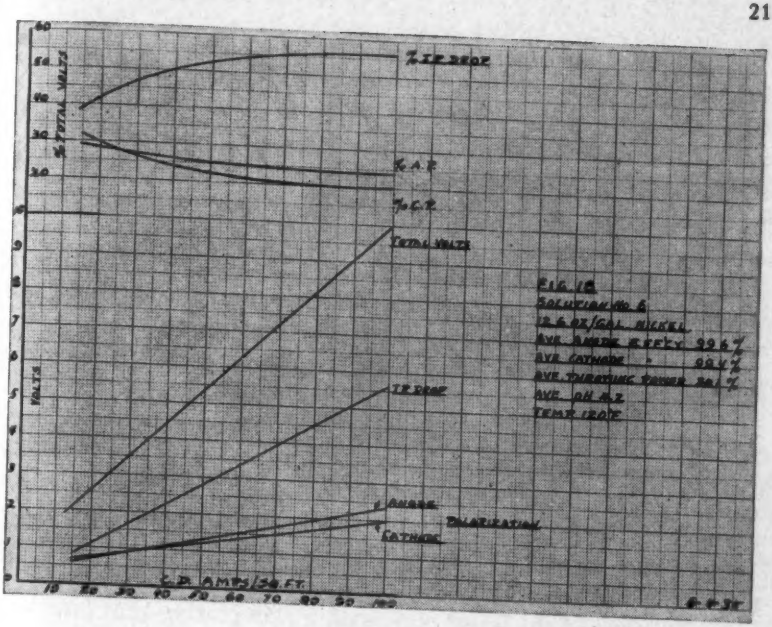
DR. COTTON: One was plated in the twelve-ounce per gallon solution at 100 amperes per square foot, 120°F; and the other one at forty-six amperes per square foot, 80°F. The plate on the polished side is a quarter of a thousandth inch thick. I took that value because that is the specification laid down for nickel on brass. I plated them all the same thickness in order to try out the polishing qualities, having the same thickness of nickel on every specimen.

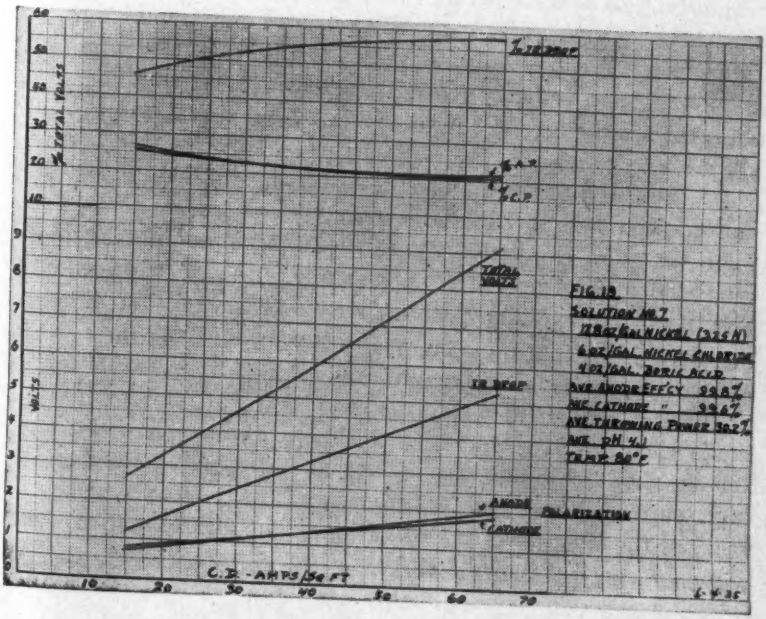
MR. ROYAL F. CLARK, SR. (Williamson Wire Novelty Co., Newark, N. J.): I enjoyed this paper very much because I have been on the practical side of Dr. Cotton's solution. Had I known about this lower pH which Dr. Cotton has mentioned, I would have saved many a headache. We were plating bumpers, and the solution was Dr. Watts'. I have an autographed copy of his paper which he sent to me. We had quite some correspondence, and we were running the pH 5.6, 5.4, 4.6, and I can readily see now that had I heard this paper ten years ago, we would have had better results on our bumpers. We did finally improve the deposit, which was rough at times.

The solution was run at 160 degrees Fahrenheit, and we were plating from two to three one-thousandths in forty minutes. We had considerable difficulty in maintaining a smooth deposit, due to the anode first used, but after getting the 99-plus (Mr. Proctor suggested this anode to me) we had no further difficulty.

We thereafter bought the anodes made by the Munning process. There was very little scum on the anode. It was easily brushed off with the finger, and we did not get the common thick deposit which we have in the lower percentage cast anode.

Recently, in the last five years, I have operated a plating barrel with the hot nickel solution and with the pH down to two. Some-


% TOTAL VOLTS
% I.R. DROP
% A.P.
% C.P.
TOTAL VOLTS
I.R. DROP
ANODE
CATHODE
POLARIZATION
VOLTS
C.D. AMPS/SQ.FT.
FIG. 18
SOLUTION No. 6
12.6 OZ/GAL. NICKEL
AVE. ANODE EFF'CY 99.6%
AVE CATHODE " 99.4%
AVE THROWING POWER 80.1%
AVE. pH 4.2
TEMP 120°F

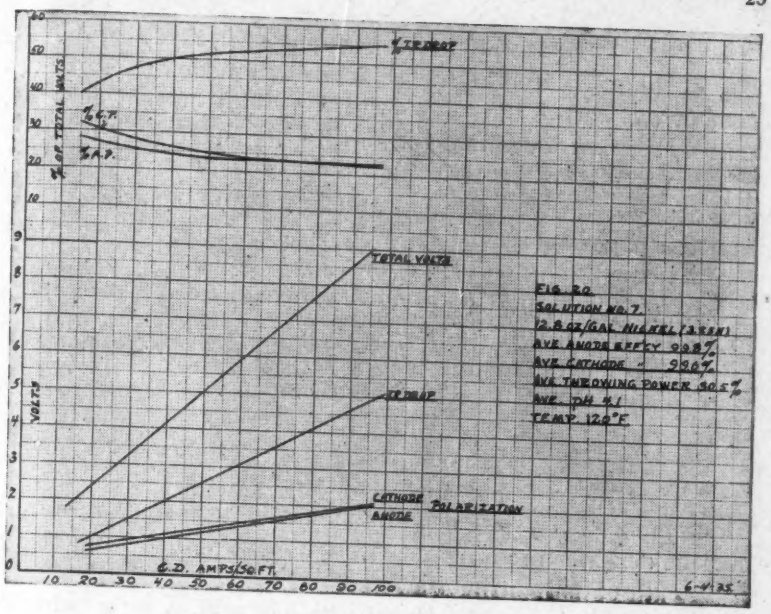

% I.R. DROP
% A.P.
% C.P.
TOTAL VOLTS
I.R. DROP
ANODE
CATHODE
POLARIZATION
VOLTS
C.D. - AMPS/SQ FT
FIG. 19
SOLUTION No. 7
17.8 OZ/GAL NICKEL (325 N)
6 OZ/GAL NICKEL CHLORIDE
4 OZ/GAL. BORIC ACID
AVE ANODE EFF'CY 99.8%
AVE CATHODE " 99.6%
AVE THROWING POWER 302%
AVE. pH 4.1
TEMP 86°F

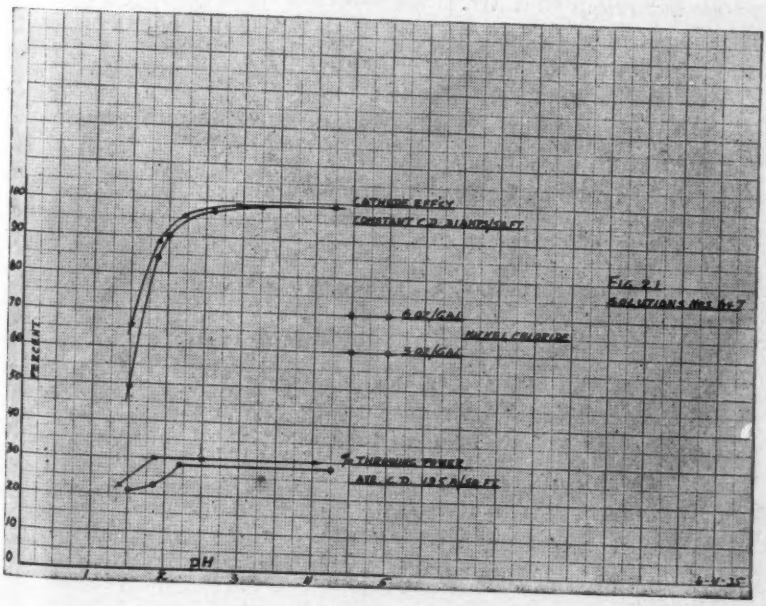
one told me with a color process it was down to one, but I use a brightener in this solution. On a piece of chain which I have here (this is run eight hours with a brightener), the pH was down around two, but I would not advise that in a still tank. I am sorry that I did not know about this ten years ago, because we would have had much better success in the plating of our bumpers.

DELEGATE PROCTOR: I just want to add a word of congratulation to what Mr. Hogaboom has already said regarding Dr. Cotton. I have known Dr. Cotton for many years, and I knew of his great interest in the nickel solutions. We have discussed nickel plating many, many times when I have been at their plant. This is a great step forward. This is the right kind of paper to be presented by technical men in this organization. It is both technical and practical, and the practical men must produce the results upon a commercial cost basis. The technical man is the man back of the plater who tries to determine the facts regarding the solution. So I sincerely congratulate Dr. Cotton, because I think it is one of the finest papers on nickel plating that has ever been presented before this organization. (Applause).

MR. HOGABOOM: Mr. Chairman, I think that probably it would be well to state before those who are using nickel solutions that Dr. Cotton's pH's were all measured electrometically, and they should not be confused with the results of the commonly used colorimetric method; that there is a distinct difference in the values according to the salt error. That was brought out by Dr. Blum.

It is also of interest to note the results he obtained from a high chloride content. In changing from the low purity anode to the high purity anode, it was found the chloride content had to be increased so as to get better anode corrosion. Dr. Cotton for the first time has explained why. His polarization was probably due to the fact that nickel is practically insoluble in the sulphate electrolyte, and it must be activated or the salts that are formed at the electrode need a chloride or something different that will make them go into solution. I should like to have Dr. Blum tell us about chloride in solutions and the high amperage, the high current density of solutions, and then have him tell his story of the effect or of the condition of the anode as such, which will confirm Dr. Cotton's work.


% THROW
% C.E.
% A.P.
% OF TOTAL VOLTS
TOTAL VOLTS
IR DROP
CATHODE POLARIZATION
ANODE
VOLTS
C.D. AMPS/SQ FT.
FIG. 20
SOLUTION NO. 7.
12.8 OZ/GAL NICKEL (2 SALTS)
AVE ANODE EFF'CY 99.8%
AVE CATHODE " 99.6%
AVE THROWING POWER 90.5%
AVE. PH 4.1
TEMP. 120°F.
6-4-35


CATHODE EFF'CY
CONSTANT C.D. 31 AMPS/SQ FT.
FIG. 21
SOLUTIONS Nos 6 & 7
6 OZ/GAL
3 OZ/GAL
NICKEL CHLORIDE
% THROWING POWER
AVE. C.D. 12.5 A/SQ FT.
PERCENT
PH
6-4-35

DR. BLUM: In the brief report of our work, made on the first day of the convention, some reference was made and slight discussion was had of the results with very high current densities, that is, three or four hundred amperes per square foot in nickel solution that were at the boiling point, and at a very low pH, practically acid nickel solutions, about a pH of one, and I think that this paper today illustrates the very great need of and value for surveying the whole field of nickel deposition.

We deliberately jumped from what we call ordinary conditions to the extreme just to see how far it was possible to go, and Dr. Cotton has filled in a large amount of that gap. With the complete analysis which I could not attempt to make today on this short notice, I think if we all study these results we will be able to find out where the change comes from ordinary conditions to the extreme conditions and why, for example, the chloride which makes fairly soft deposits at moderate temperatures and current densities produces relatively hard deposits at the higher temperatures and current densities.

I think this is, as Mr. Hogaboom has said, a very valuable contribution in helping to survey the whole field which is still, in all fairness, not yet completely covered. The question of the anode behaviour that Mr. Hogaboom has referred to is important. Of course, in working with very high anode current densities of 400 amperes per square foot or more, we had very rapid solution of the anodes, and consequently rapid accumulation of sludge, even though the proportionate amount of that sludge might not be very high. Practically in our laboratory experiments, the chief difficulty or objection was the fact that the sludge accumulated in the bath and increased the resistance of the bath, and since we were trying to get as high a current density as we could with our generator, that, of course, limited the current density that we could use.

I believe, as Mr. Hogaboom has hinted, there is a great need for study of the behavior of nickel anodes under these unusual conditions. There is no reason to suppose that a type or composition or structure of nickel anode that would necessarily give the best results, say, at room temperature and 20 amperes per square foot, is going to give the best results at, say, as Dr. Cotton said, 100 degrees Fahrenheit or higher, and current densities of 100 amperes, much less at 300 or 400.

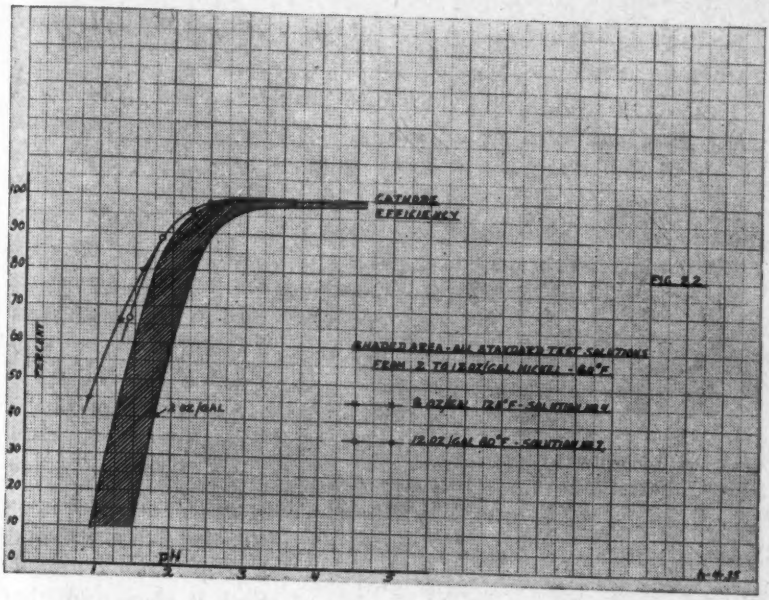

CATHODE EFFICIENCY
PERCENT
pH
SHADED AREA - ALL STANDARD TEST SOLUTIONS FROM 2 TO 12 OZ/GAL NICKEL - 60°F
8 OZ/GAL 70°F - SOLUTION NO 9
12 OZ/GAL 60°F - SOLUTION NO 2
3 OZ/GAL
6-4-35

FIG. 2.2

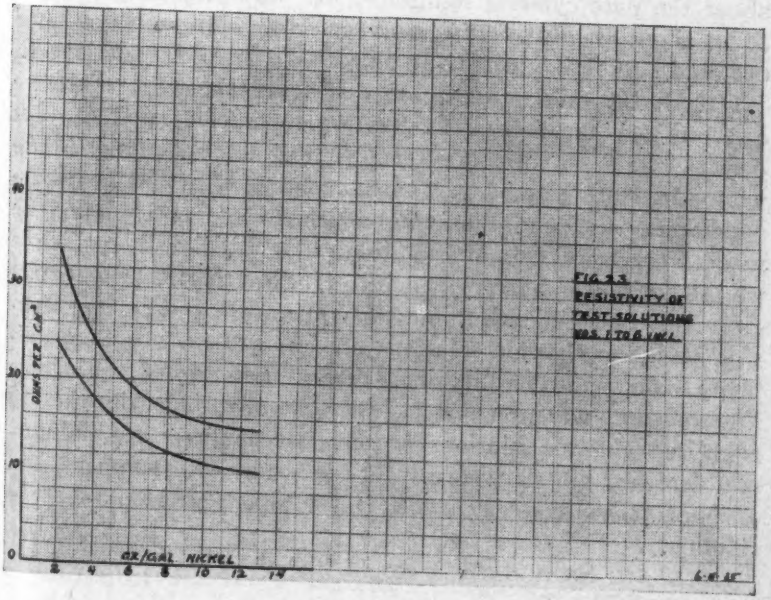


FIG. 2.3
RESISTIVITY OF TEST SOLUTIONS NOS. 1 TO 8 INCL.

So I say again that we have lots of work to do, even on so simple a thing as nickel plating. (Applause).

DELEGATE PHILIP SIEVERING (Newark Branch): I am somewhat surprised to hear of the advance made with the sulphate bath and the advantage of using the chlorides. I often wonder why a study has not been made in the pure chloride baths of nickel. I have worked with chloride baths since away back in 1882, '83 and '84, and I think the place I worked at was the only concern in the country that worked a pure chloride of nickel bath. We had very good results, high efficiency, and so forth, although the lack of technical knowledge and instruments at that time hindered us somewhat. There is no data which I could use in order to give an explanation of its advantages over the sulphate, but I know at the time we could deposit a given plate in one-half the time in a chloride bath that we could with a double sulphate, but from the expressions which you hear today and from year to year, I gather the chloride contents are increased. I was surprised that these scientific men and research people have not made a study of the pure chloride baths. I think if they took that into consideration they would find a great improvement.

MR. HOGABOOM: Dr. Blum, can't you tell us something about the pure chloride solution? Mr. Sievering stated something about the value of a pure chloride solution. You tried one, and I think it is well to go on record with your experiences.

DR. BLUM: We must again distinguish between what we call ordinary conditions, moderate temperatures and current densities, and extreme conditions. A good many years ago in the work Mr. Haring and Mr. Thomas conducted, under moderate conditions, we found that very satisfactory deposits could be made from pure chloride solutions. So I think in principle we are entirely in agreement with Mr. Sievering, that when we go to these extreme conditions of temperature and current density, then the chloride solutions are less satisfactory than sulphate so far as the ductility of the deposit is concerned. I believe if there is any advantage or necessity, we might consider the use of entirely chloride solutions for moderate temperatures and current densities, but since we can get the results with sulphate, and of course the sulphate is cheaper, it is not likely we would use the chloride.

DELEGATE SIEVERING: I would like to ask the doctor one

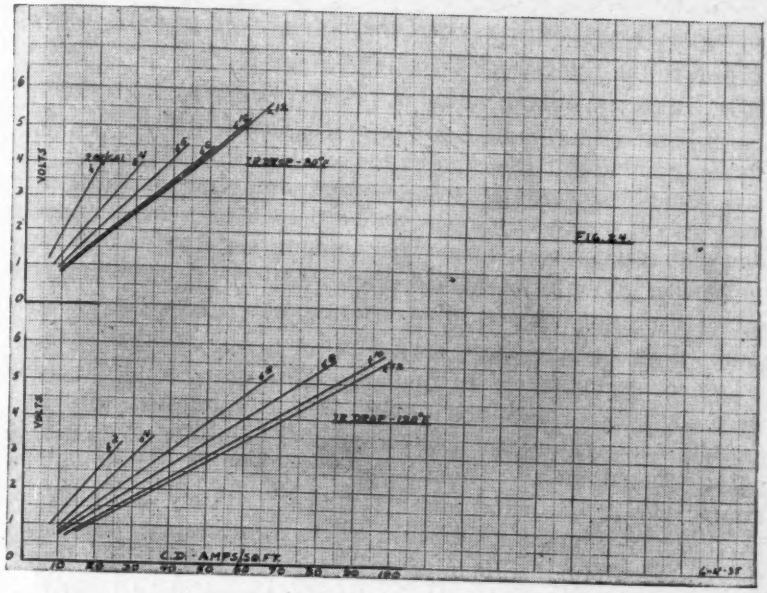

VOLTS
IR DROP - 80°C
IR DROP - 120°C
C.D. AMPS/SQ.FT.
6-4-35

FIG. 24.

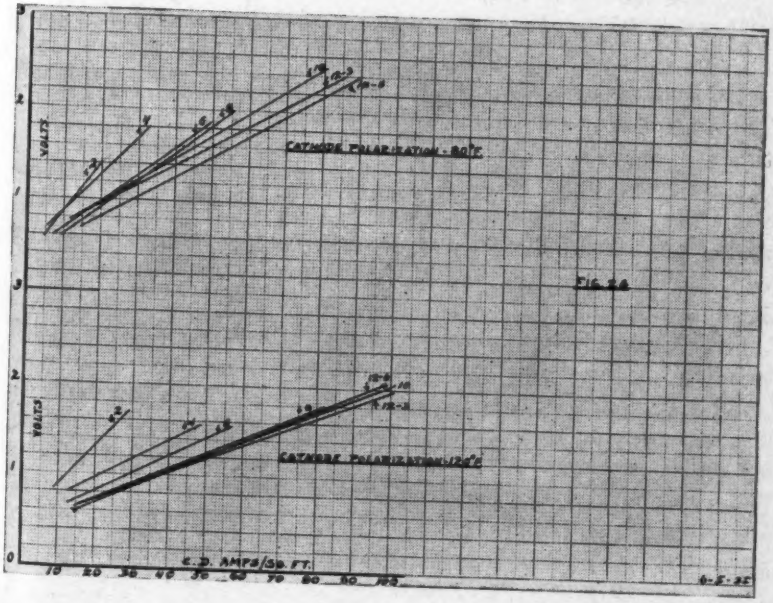

VOLTS
CATHODE POLARIZATION - 80°C
CATHODE POLARIZATION - 120°C
C.D. AMPS/SQ.FT.
6-5-35

FIG. 25

question. Have you increased the boracic acid content in proportion to the chlorides?

DR. BLUM: We have varied it. Again I say "we", as nobody else has made a complete study of this whole thing. As Dr. Cotton pointed out, there are a lot of variables that he did not have time to include in his investigation. One of those undoubtedly is the effect of boric acid, although the general impression is that when we get a certain amount, say from two to four ounces per gallon of boric acid, then its effect in controlling the pH of a solution is practically constant. At least, we do not get much effect of changing the concentration of boric acid after that.

DELEGATE PROCTOR: In England, I think, the solutions used were the nickel-chloride solutions. I was connected with my grandfather as a boy, running errands. I happened to go into a plant. The name was Thomas Smith & Sons. They were making bicycles at that time, and I was a rather nosey chap, always peering into things. I happened to get into the plating department. That was the first time I looked into a nickel plating solution. The man who was operating the solution looked at me. I looked down into the solution and said, "What is that?"

He said, "That is a nickel solution."

I don't know why I asked, "What kind of a solution?"

He said, "What do you want to know for?"

I said, "I just want to know."

He said, "That is the nickel ammonium chloride solution." They were using the nickel ammonium chloride solution at that time.

I am going to say so far as deposits were concerned, in all the years they had the high bicycles and even when they started to make the safety bicycles, I never saw a peeled deposit. There can still be considerable work done on the chloride solutions, in my estimation.

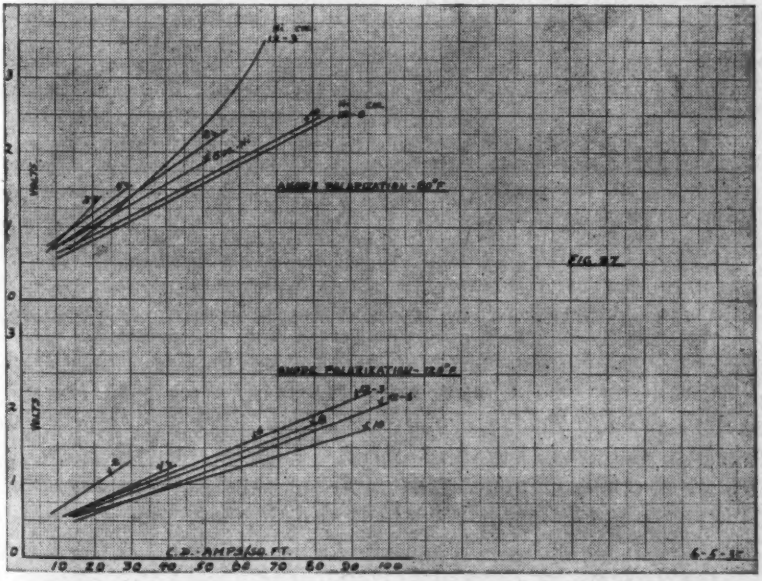
MR. STRAUSSER: Following up the remarks on Dr. Cotton's excellent paper, I am wondering whether you have made any special comparison, Dr. Cotton, in the nature of the deposit, that is, studying these polarization curves so far as piting of the nickel is concerned. The reason I bring that question up is this:

I have noticed Dr. Kasper's work on the rapid deposition of nickel and the boiling solution temperatures at high current densities. At no time was pitting of the nickel apparent, whereas

in the cold solution, of course, we do generally get into that condition. I wonder if there is any special significance connected with the polarization curves and pitting of nickel?

DR. COTTON: I cannot say that I observed any direct relation. I will say that, as a rule, the pitted samples were plated in cold solutions and, also as a rule, the abnormal polarization values occurred in cold solutions. In all the specimens I plated (that is getting aside from the question), there were no samples that had any blisters. They all seemed to be adherent plates. Among the data that I have, I have a description of every sample, that is, whether it was pitted or what the condition of the surface was. Of course, things like that could not be included in a report of this short length, but all the specimens were polished and examined, and just the few cases I pointed out showed that where the anode and cathode polarization departed from what I called their normal relation, they were not as good samples as in those cases where the anode and cathode polarization maintained that normal relation, as I called it.

MR. STRAUSSER: There, again, I believe Dr. Kasper is confirming Dr. Cotton's work on the degree of adhesion. You get a



better degree of adhesion at the high temperatures and current densities than otherwise.

MR. HOGABOOM: We have Dr. Vuilleumier with us. Can't we hear from him on some of this discussion? This is Dr. Vuilleumier, of Dickinson College, who worked on the contractometer.

DR. E. A. VUILLEUMIER: I do not know that I have anything in particular to add to this discussion. My work on the contractometer, incidentally, was done with nickel chloride solutions. I want, however, to take this opportunity to congratulate the members of the Electro-Platers' Society, on the marvelous progress which they have made in their science and in their art since 1916, when I first became interested in nickel deposition in Switzerland. There has been one serious disadvantage, however, to this progress which has been made from a professorial viewpoint.

Years ago, when I used to talk to my students about nickel peeling, they all knew exactly what I was talking about, because we were completely surrounded in those days by nickel plating that either had peeled, was about to peel, or was in the process of peeling.

Nowdays, when I talk to my students about the peeling of nickel plating, they look absolutely blank, and the modern college student has brought the art of looking blank almost to perfection. The only specimen of nickel plating which has peeled in the entire borough of Carlisle is the rear bumper of the car belonging to the professor of Greek. This car is over ten years old, and belongs to that early day that Mr. Young, I believe, was referring to. I am dreading the day when our professor of Greek turns in that car, because I won't be able to show my students any more examples of the peeling of nickel plating. (Applause and Laughter).

MR. ROYAL F. CLARK, SR.: I spent three and one-half happy years in Bridgeport plating shears. We were the largest shear manufacturers in the country. They were cast iron shears. I had an opportunity to study nickel plating in the cold solution and in the hot solution. I had thirty-eight nickel tanks and during the war we had to add more tanks to our room. I suggested

that we put in hot nickel solutions. Of course, I could not use the Dr. Watts solution. I had to use the double sulphate and single. I had an opportunity there to study all manner of solutions, and it was my one regret that I left there before I was able to start this.

I wanted to take each tank and have the different proportions of boric acid. For instance, we take double and single nickel sulphate, boric acid and common salt, and then one with ammonium chloride and one with boric acid alone, and all manner of interchange of the addition agents. I wanted to keep an accurate record and my fondest hope was to present that paper to some convention of the American Electro-Platers' Society.

I found that by heating the solution up to 110—of course, this was a low current density solution which must be used on the plating of shears, because after the shears are put together with rivets they are ground. They must be sharpened so that they will cut. If they begin to peel, in fact, if you have a days' peeling, you might as well put on your hat and coat and go home. There are two or three hundred gross of shears a day produced. It is a problem. When I stop to think of it, it was so simple that really there was nothing to nickel plating, but I think a man who plates shears is on the highest pinnacle in the field of the electrodeposition of nickel.

I found that by heating the solutions to 110°, I could get one and one-half thousandths in an hour against one one-thousandth in the cold solution. I was amused. The buffers next door to the plating department were standing around waiting for work when I had perhaps fifty or sixty boxes there. They would stand around waiting for work, and I asked the foreman buffer, "What are the men standing around for? There is plenty of work."

"They want the hot solution on shears because it is much easier to color. It is a softer deposit, and they can do twice as many gross as they can on the cold solution."

That shows you that in heating the solution you get a softer deposit and a much heavier deposit.

CHAIRMAN SLATTERY: I wish to thank Dr. Cotton, and I am sure we all agree with the very fine comments that were made on his excellent paper.

What **Holds** *Most People* **Back** *in Life?*

By EDWARD H. TINGLEY
Secretary
National Association of Foremen

All normal people want to succeed. They want to make money. They want to be well and happy. But, you ask, "Are these things possible for everyone?" There are so many failures in the world despite all the progress of science and engineering that has made this the finest civilization the world has ever known.

What is wrong? Simply this: Progress has been so much greater on the material side of life than it has on the human. People have not kept pace with progress.

But what is wrong with people who do not succeed? What holds most people back in life? Two outstanding things:

They resist the new.
They resent criticism.

A Boston newspaper of 62 years ago said; "A man has been arrested in New York for attempting to extort funds from ignorant and superstitious people by exhibiting a device which he says will convey the human voice any distance over metallic wires . . . Well-informed people know that it is impossible to transmit the human voice over wires, and that, were it possible to do so, the thing would be of no practical value."

This was how people ridiculed the telephone when it was first introduced. Now it is one of the most valuable and practical instruments in use today, both in business and social life. These people resisted the new.

How many of us feel the same today about the inventions we are using, as when they were first introduced. Did we want them to succeed or did we pick out the bad points and condemn the new idea? Were you one of the first to wear soft collars? Have you had your first ride in an aeroplane—or are you still skeptical of its safety and reliability?

Mr. C. F. Kettering, Vice President of General Motors, in charge of research says, "The greatest endurance contest is getting a new idea into a factory. The best way to kill any idea is to give it to a committee of experts. They will table it and condemn it. It seems pretty much of a definite law that man is so

constituted as to see what is wrong with a new thing and not what is right."

If we want progress in this world or in our own shop, we ought to train ourselves and train others to see the good in new ideas and to be anxious to have better methods, better machines and new equipment, succeed.

Glenn Frank writes in the newspaper:

"The majority vote is as yet the best mechanical device which we have to keep things operative, but as valuable as it is, the majority has never yet acted on any important thing until it was prodded on by the minority. So I propose that we let the right of decision with the majority, but we let the right of discussion with the minority. Yes, I propose we let the peace of society to the majority, but we let the progress of society to the minority."

Are we going to be with the crowd, which says a thing cannot be done, and thereby be a factor of safety, or are we going to be with the few and be a factor for progress? The fact is that progress is halted less by men who know too little, than by the expert who knows too much. Knowledge and courage are ever at war. It often takes courage to try the new idea.

Well—what about all the experience we have had. We have worked many years at our trade. We know all the tricks. Listen to Glenn Frank again:

"Some men assume that, because they are doing a given job, and thereby gaining experience, they are becoming increasingly qualified for such a job.

But experience may be bad as well as good. Experience may mean that we have done something wrong for a long time.

It is important to remember that experience is not a matter of years, but is a question of the way in which we have reacted to our jobs or permitted our job to react on us."

So I am pleading that we keep our minds open, that as we grow older we do not get that "know-it-all" attitude. We should attend conventions, meetings of our local society and visit other factories and shops, looking for better methods and new ideas. The world is constantly changing.

If so many people resist new ideas and try to discourage the inventors, how then can we account for the progress that we do enjoy. It is due to two things:

(1) The occasional inventor who is intensely interested in making something better.

(2) Competition.

Competition can be called the great universal supervisor. Somebody comes out with a new product, and immediately his competitor tries to improve upon it, realizing that he must if he is to get the business. Then the first man improves upon that and somebody else improves upon that, all of course, to please the public and secure the business.

Competition is the force that puts us to work and that puts many of us out of work. We must admit that every product that has made outstanding improvement was a highly competitive article. Competition enables us to buy the most for our money and forces good work to be done all over the world. Competition seems harsh but it is the basis of all progress.

Here is a thought for each of us. Have I kept pace with progress? Has my department or shop kept pace with progress?

Do you think people dislike to be criticized? Or do they like to be told when they are wrong? How many people do you know, whom you would be just as quick to criticize as to compliment? Not many, I wager. Its just human nature to prefer to be flattered rather than criticized. But it is absolutely necessary, if you are going to succeed, that you be told when you are wrong. For when you are right, that will take care of itself.

At a factory in the middle west, I saw a sign which read:
The People who help me most are those who tell me when I am wrong.

This idea impressed me very much. As we look back over our life, we will have to admit that the people who have helped us most in the past ten years are those who have shown us where we were wrong. And looking ahead the next ten years—we will feel the same way, I am sure. But then, why do we get angry if someone tries to tell us today, that we are making a mistake? Our face gets red, our nostrils distend, we breathe fast and apparently we are very much annoyed—at least we are not pleased.

We answer back that "If people would just take care of their own business"—and probably a lot more harsh words. If criticism is so good for us, why do we so constantly resent it? Then too, most of us do not criticise until we are half angry, and of course our criticism is of the wrong kind. The person being critized gets angry in turn, and instead of getting any good out of the discussion, both parties become enemies. Maybe it is our method of making the criticism that causes all the trouble.

Here are four rules that may help to popularize the giving of criticism:

The Subject	(1)	Be sure the thing you are going to criticize is worth the time and effort that it takes to give the criticism.
The Method	(2)	Criticize in just the same manner that you would want criticism given to you.
The Amount	(3)	Be just as quick to notice good work as poor work.
Then What?	(4)	When you have criticized something and it has been taken care of, then do not mention it again.

And it's so necessary that all of us get the benefit of the thoughts of other people. This is particularly true of all who manage a business or a department. Yet due to the fact that most people resent criticism, most managers, superintendents and foremen do not get the ideas of their workers, but on the contrary their employes are apt to compliment or agree with them. The most important thing for everybody in any managerial job is to get the facts, because all judgment must be based on facts, or conclusions are going to be wrong. But too frequently, those who are supposed to give the facts do not do so, unless they think they will please the boss. Only a few venturesome souls will dare speak out against what they think their superior wants to hear.

The greatest compliment any man pays his boss is that he honestly tells him exactly what he thinks. If we could only assemble the intelligence of the plant, we could solve most of the problems of that plant. One of the most helpful things that can be done in any organization is to get one foreman really wanting the criticisms of another or of the employes. The same idea should apply to suggestions for improvements in the products or the methods; the foreman should welcome them sincerely and give proper credit to the man making the suggestion.

The whole subject of resisting the new and resenting criticism is a broad one. It's the basis of progress for the individual but requires on his part the open mind. And it does not come easy to most of us. We must teach ourselves to be on the lookout for help from the most unexpected sources and we will find it easier to keep pace with progress.

Barrel Burnishing

AN EXTENSIVE ABSTRACT

by

WALTER R. MEYER

Due to the scarcity of good literature on barrel burnishing this German article by Dr. F. Schwarz "Das Polieren in Trommeln" from Oberflächentechnik Vol. 12, No. 20, 1935, pages 243-247 has been extensively abstracted for the MONTHLY REVIEW.

Barrel burnishing is primarily intended for bulk work to replace the expensive and more troublesome hand buffing. The soft metals such as copper, brass, zinc, silver, aluminum and its alloys are easily burnished but the harder metals such as cast iron, steel, bronze, etc. are more difficult. Copper, brass, nickel, and cadmium plated bulk work may be burnished to a high luster, but chromium plated ware is burnished with considerable difficulty.

Barrel burnishing may be divided into several types of technique, namely:

1. Dry burnishing in which mostly dry burnishing agents are used.
2. Wet burnishing in which soap solutions or solutions of burnishing salts are used.
3. Ball burnishing usually in the wet way.
4. Scouring by the use of etching agents such as acids with the addition of coarse abrading substances such as sand. This last method is really not burnishing in the usual sense, but is a cleaning and scale removing process previous to burnishing.

The size and form of the burnishing barrel depends largely upon the type of work to be treated. They are usually made out of hard wood such as beech, although iron is sometimes used, and they are round or of many corners. The long narrow barrels run at higher speeds than the shorter larger diameter barrels. The large diameter barrels burnish faster because of the greater pressure of the work, but they require consequently more power to run them than the long barrels.

MECHANISM OF BURNISHING

The process of barrel burnishings is of a complicated nature, consisting first of an abrading action in which the minute projections are worn off with some plastic flow. This action is followed by a pressure homogenization of the surface in which the repeatedly applied pressure works the higher points into the minute grooves resulting in a more or less mirror-like surface. This is analogous to the pressure polishing of gold and silver in which a mirror-like surface is obtained without removing any metal. Both of the above actions are accompanied by an etching process which keeps the metal free from oxide. A burnished surface consists, therefore, of a severely cold worked layer of metal with a very fine crystalline structure. Such surfaces have greater resistance to chemical attack or corrosion than the unburnished metal.

Articles weighing over a pound may be burnished in barrels by fastening the work in the barrel. (See R. J. O'Conner, Met. Ind. N. Y., 29, 1931, 523). The form of the work to be burnished is very significant as certain shapes nest together and will not separate during the rolling while other shapes may have sharp corners or thin sections which preclude a barrel treatment.

SCOURING

Scouring or removal of oxides or scale is usually done in a watertight, hard wood, cylindrical barrel. The work is put into the barrel with sand and sulphuric acid to make a 1-5% solution of acid and tumbled from 30 to 60 times a minute. Sharp sand will be much more effective than the round sea sand. Brass and bronze articles usually require from 10-12 hours burnishing; steel, 20-30 hours; and cast iron from 40 to 60 hours. The barrel should be opened every 5 hours, and the work examined but new sand should not be added as the sharp edges may scratch the surface of the work. The iron articles upon completion of the scouring are removed, dipped in 10% sulphuric acid and then transferred to another burnishing barrel. In some cases a dry scouring tumble is used after the wet scour in which sea-sand, leather scraps, or pumice is used. Scouring is seldom done on aluminum or zinc die castings or on pressed stock.

WET BURNISHING

Wet burnishing without balls is only for that class of work which by virtue of its own weight can exert enough pressure for a burnishing action. Cavities will not be burnished in this process. Wooden barrels are rotated from 30 to 50 times a minute and care must be taken to completely cover the work with water. It is usually a good plan to have the water level at least one inch above the level of the work.

The burnishing agent has several functions to perform. It first must serve as a gliding agent so that the pieces of work can slide over one another without a strong abrading action. At the same time it must not allow the metal chips to be emulsified, and it must clean the surface of the metal. It must also have a slight etching action to remove any oxides and to prevent oxidation. The most important agent in the solution is the gliding agent as the finish is the best when the polishing action is at a maximum and the pressure burnishing is at a minimum.

Soaps were formerly used alone as burnishing agents, but their tendency to form metallic soaps and their lack of an etching action necessitated frequent renewals at considerable expense. O. Hahn recommended the addition of sodium cyanide to the soap with an improvement in results. Additions of boric acid, borates, citrates, tartrates, and oxalates have all been recommended. Soap solutions with additions of one of these materials can be used several days for burnishing. If the soap foams too much, an addition of alcohol will greatly reduce the foam.

During the last few years the soap solutions have been replaced by neutral wetting agents such as sulphated alcohols, esters of fatty acids, or fatty acid derivatives and oxyalkyl sulfonic acid derivatives. These substances are more stable than soap, but they also require a mild etching agent to remove oxides. Some specific burnishing solutions are as follows:

For Aluminum	Acid potassium or sodium fluoride	.7	oz. gal.
	Igepon or Nekal	.13	" "
	Sodium bisulphate	.5	" "
For Iron and Steel	A Basis Solution		
	Soap flakes	5	" "
	Soda ash	2.5	" "
	Sodium cyanide	.7	" "
For Copper and Copper Alloys			
	Soap powder	4	" "

Soda ash	3 oz. gal.
Sodium cyanide	.13 " "

BALL BURNISHING

Ball burnishing is particularly valuable for recessed or sharp work. The same burnishing agents that are used in the wet process just discussed can be used for ball burnishing although the burnishing can also be done dry. The quality of the ball used plays an important part in securing a good finish. The most satisfactory are the hardened, highly polished chrome steel balls, whereas the cast ordinary ball offers some specific difficulties. They do not have the highly polished surface of the steel balls, and they are liable to crack during the tumbling causing scratches on the work. The size of the ball to use naturally depends upon the size of the work and of the recessed portions on the work. Jacks and variously shaped steel slugs are often necessary for small openings or for work with difficulty accessible recesses. The balls must be kept scrupulously clean and free from rust, and the work must be completely imbedded in the balls. For best results the quantity of balls should be from two to five times the quantity of the work. The barrel should not be more than two-thirds full to allow the work and balls sufficient room to move about. The speed of the barrel may vary from 20 to 40 R. P. M. at which speed brass may be burnished in an hour and steel in 2-3 hours. Soft metals such as aluminum require only from .5 to .75 hours.

Dry burnishing with or without balls is usually done on plated coatings and finds its greatest application in the burnishing of nickel plated work or in the burnishing of copper before plating. Dry burnishing with leather scraps with the addition of Vienna line, alumina, rouge, etc. is done on aluminum and zinc to a large degree. The work is burnished at 20-40 R. P. M. from ½ to 2 hours.

Dry burnishing finds its greatest application for work such as screws which must not be abraded. The screws are burnished from 1 to 2 hours in hard fine sawdust using an excess of sawdust so that the screws do not rub together. When fine sawdust is used, it wedges in the threads of the screws and cushions the threads from abrasion.

Modern Filtration Practice *in* Electroplating

By MR. PACE
Miller Corporation,
Grand Rapids, Mich.

Read at Detroit Branch Meeting

DURING the last few years heavy electro-deposits have been demanded and produced. The automotive industry in its quest for materials, which possess a pleasing appearance and which will endure severe service conditions, have sponsored this movement toward heavy plated deposits and now manufacturers of all plated articles are becoming thickness of plate conscious. Such specifications have brought new problems to the plater because he has been asked to produce these deposits at very little added cost. His ingenuity has been taxed to the utmost and he has been forced to seek new and improved methods for all of the procedures used in plating. There has been decided improvements made in the solutions he uses and with these improvements the efficiency of his equipment has also been improved.

Perhaps one of the most important phases of producing thick deposits is the clarity of the solutions used for plating. It used to be possible for the large majority of plating plants to operate plating solutions for months without filtering. The deposits were thin, very low current densities were used, the solutions were operated cold and usually no agitation was needed. When the solutions became so dirty that it was no longer possible to obtain smooth deposits free pits and occluded matter, the solution was allowed to stand until the top portion was clear, then it was carefully decanted and the sludge and solution at the bottom thrown away. This was common procedure in all but a few of the larger plants. Such methods of course were crude and very wasteful and no one today would be expected to use them because we have filters, which will remove all suspended matter rapidly and thoroughly.

Nickel deposits ranging from .0005″ to .001″ in thickness are being produced today at a very little increase in cost, except for the increased amount of metal deposited. They are being plated from hot solutions, in some cases agitated and at very

high current densities. These solutions must be kept clean and free from suspended metallics, sludge, etc. If they are not, rough, pitted deposits and subsequent rejections are the inevitable result. Suspended particles lodge on the cathode and the plate builds around or over them. When the deposit is buffed these particles either pull out and leave a pit or they adhere making the subsequent buffing operation very difficult.

In order to show what actually happens, when solutions are contaminated with metallics, we made up a brite nickel plating solution, into which we introduced a small amount of iron dust from a grinding wheel. The solution was agitated and plating carried out at 30 amperes per sq.ft. Brite nickel solution was used because the structures obtained illustrate what happens when the deposit builds around a metallic more clearly than would be the case with a regular nickel deposit. The specimen was mounted in a cadmium zinc alloy, polished and deep etched with concentrated nitric acid. This first slide was made of a brite nickel structure from a solution, which was free from solid particles. The picture was taken at the corner of a test specimen and at 1000 diameters. You will note in this case that the deposit consists of very evenly deposited layers of crystals. The next slide was made of a specimen from the solution containing minute particles of iron. In this case the iron is the black portion in the center of the projection and the deposit has built up around it. Another thing is noticeable here and that is that the deposit is quite a bit thicker at the point than at the sides, due to the concentration of current at this point. The picture was taken at a magnification of 450 diameters. It requires but a very little bit of imagination to visualize what would happen if this deposit were to be buffed. These projections would tear out and leave holes. The next slide is another picture taken of the same deposit where two iron particles happened to lodge at the same spot.

Deposits and formations such as these are not uncommon where the plating room is located near the polishing room. Continuous filtration in such cases is an absolute necessity. The careful plater either filters his solutions at frequent regular intervals or provides for continuous filtration.

Research and experience has shown that nickel deposits are especially susceptible to the presence of small quantities of iron, copper and zinc in solution. These undesirables can be easily removed by proper purification methods, which involve the use of a filter. A great many solutions which gave trouble in the past and were discarded could no doubt have been saved had such methods been known and used.

Filtration is being used to good advantage on other solutions such as cyanide copper, acid copper, cleaners and in some cases chrome, zinc and cadmium solutions. Deposits from filtered cyanide copper solutions have been found to be smooth enough so that it was not necessary to buff them before nickel plating, this even in cases where the nickel plate was very heavy. Eliminating the copper coloring operation, of course, materially reduces the cost of plating and eliminates the possibility of buffing through the copper.

Mr. Phillips in his paper, "The Pictorial Study of Plating Solutions", suggests that the filtration of cleaners might show surprising economies. I know of no one who is actually filtering cleaners, but it is logical to believe that if the discharged particles of dirt are removed from the solutions, the life of the cleaner could be materially increased. I think that this would be especially true where cleaners are controlled chemically and kept at the proper alkali concentration.

APPARATUS USED FOR FILTERING

There are several types of filters used in various industries, such as leaf type, cartridge type, recessed plate, plate and frame and others. Of these various filters the types used in the plating industry are the cartridge type, the plate and frame and in some instances the recessed plate.

Filters used most commonly in plating have been the cartridge type. They consist of a tank containing filter bags supported by grooved boards. These filters have been a decided improvement over the old straining and decanting methods of taking the suspended particles from solutions. Due to the small amount of space in the tanks, the filtration area possible is rather limited. This factor either limits the speed of filtration or the efficiency of the clarification. If speed is desired, then it is necessary to use a filter cloth of more open weave, which of course allows a

greater number of small particles to pass thru the openings. Centrifugal pumps are used with this type of equipment. As the cloths become dirty the back pressure against the pump increases and under these conditions, the volume of solution delivered decreases. It is then necessary to take the cover off the tank and to thoroughly clean the bags in order to keep the filter delivering at its rated capacity. As the filtering is usually done during week-end periods a great deal of extra time is consumed in these cleaning operations.

In recent years some of the filter manufacturers have adopted filter presses, which are used in other industries, to the filtering of plating solutions. The type which seems most adaptable for plating solutions is the plate and frame filter press. Such a filter consists of a frame or cake cell through which the solution enters and a plate over which the filter cloths are placed, which support the cloths and thru which solution leaves the press. This slide represents a cross section of a filter press and clearly illustrates the flow of solution. The dirty solution enters the cake cells through ports A, goes through the cloths and out through port B. It can be seen that it enters each frame at the same time and is discharged from each plate simultaneously, and does not flow from one cell to another. If at any time a break occurs in a filter cloth, the plate which it covers and the frame adjacent to it may be removed without effecting the rest of the filter.

The plates and frames are held together by means of two heavy cast iron squeeze plates H with a screw closing device E. On some large filters of this type, hydraulic rams are used for opening and closing the press. The whole filter is supported on a frame which may be mounted on casters or can be located permanently as desired.

CLEANING

A new feature which we have incorporated in our filter press is that we can force water through the press in the reverse direction, which enables the operator to clean the filter without removing plates and frames. This is especially effective if a slightly acidified water solution is used to clean the cells. A slightly acid solution will dissolve the gelatinous precipitates which tend to clog the pores of the filter cloth. The reversal of flow through the press is made possible by the grid construction

of the cake cell; the grid supports the cloths preventing them from going together. A smaller number of strips are used in the cake cell grid because the pressure is very small during this operation. A great deal of time is saved by this way of cleaning the filter, and it is only after long periods of operation, that it becomes necessary to remove the plates and frames and actually scrub off the cloths.

CONTINUOUS FILTRATION

The tendency in most of the larger plating shops is towards continuous filtration. In these plants the plating operations are carried out in full automatic or semi-automatic tanks of large capacity, where intermittent filtration would mean frequent shut downs. In such cases the intake to the filter is placed on the bottom of the tank and the clarified solution returned to the top. In this manner a circulation of solution results, which keeps suspended matter moving to the inlet of the filter. On one job, which we recently installed, a preheating unit was installed in the return line from the press, which will entirely eliminate the necessity of having coils in the bottom of the tank. In such an installation, the temperature of the solution can be maintained, uniformly and the elimination of the coils will facilitate the cleaning of the tank.

Circulation of the solution by continuous filtration also prevents stratification of the solution, which takes place during electrolysis. This of course, insures uniformity of plating on the top and bottom parts of the rack, in so far as the solution is concerned.

INTERMITTENT FILTRATION

In plants where a number of tanks are used or where it is necessary to purify solutions at regular intervals, it usually is more economical to use intermittent filtration. In this case, it is desirable to use filters of large capacity. For installations of this type, a storage tank is provided where the solution can be pumped and treated chemically to remove undesirable impurities. Purification processes involve the use of lime, nickel carbonate or other agents for raising the pH of the solution. If the purification is carried out in the plating tank, it is necessary to thoroughly clean the tank and anodes after the solution has been pumped out to remove these materials and precipitates. It is

much faster and easier to clean a reserve tank, which has no electrical connections, work rods, etc. In some plants two reserve tanks are provided and a clean purified solution kept in one at all times. With such a set-up it is only necessary to return the purified solution to the plating tank and operation is resumed without holdups.

PUMPS

A very important part of a filtering unit is the pump. In order to filter at the speed required in modern plating plants it is necessary to use a pump, which will deliver large quantities of solution at high pressures. Centrifugal pumps have been commonly used for filtering units. Of late the diaphragm type pump has been introduced.

There are several advantages of this type over the centrifugal type. One of these, from the standpoint of filtration is that a diaphragm pump will deliver a constant volume of solution even against increased pressures. This is important because as the filter cloths become dirty the back pressure against the pump increases. Under these conditions the volume of solution delivered by the centrifugal pump is that it requires no priming. Priming is a time consuming operation in filtering plating solutions. Often it is necessary to prime a centrifugal pump several times while filtering a tank. This is especially true if the operator fails to see that the intake hose is not kept below the solution level.

Diaphragm pumps require no packing glands or stuffing boxes. This also eliminates a very annoying feature of the centrifugal pump. The only parts in contact with solution being the diaphragms, the cylinder heads and manifolds.

Diaphragm pumps can be operated at relatively slow speeds, which materially reduce the wear on moving parts.

THE USE OF FILTER AIDS

Filter aids, such as Standard Filter-cel, Super-cel, and Hyflo-Supercel are being used to advantage in filtering plating solutions. By using these compounds, the filter cloths do not become clogged with gelatinous precipitates, which are present in the plating solutions.

The usual procedure in using these filter aids is to first precoat the cloths, by passing a mixture of water and filter aid or a mixture of previously filtered solution and filter aid thru the press. The filter aid is deposited on the cloths in a porous film, which will retain all solid particles not in solution and allow only clarified liquid to pass. There are several advantages to precoating the cloths. In the first place, these filters aid are not compressible and they therefore maintain an open pore structure, the pores of which are decidedly smaller in size, but a great deal more numerous than the openings in the cloth. This means that the size of particles which will be removed will be very much smaller and yet with the extremely large number of pore openings the speed of filtration will remain constant and in some cases be increased. When it becomes necessary to clean the filter it is considerably easier to remove the cake and thoroughly wash the cloths. With a press arranged so that water can be pumped thru the cells in the reverse direction, cleaning becomes necessary only after long periods of operation. Without the precoat, it is necessary to remove the plates and frames and to scrub the cloths with a brush to remove the slimes, which accumulate in the pores.

Filter aids can be purchased in three different grades, which vary in porosity. The particular filter aid which is recommended for this filtration is Hyflo-Supercel, which will remove slimy or colloidal type material of less than 0.1 micron in size (1 micron is equal to 39/1,000,000 of an inch).

After the cloths have been precoated the dirty solution is then filtered. In order to build up a cake, which maintains a relatively open porous cake, filter aid is then stirred into the solution to be filtered. This slide shows a typical filtration system used in other industries where filter aids are employed. In starting such a cycle valve V-1 is opened and valve V-2 is closed. The mixture of solution and filter aid is then pumped thru the filter until an amount of filter aid equivalent to 5-10 lbs. of filter aid per 100 sq.ft. of filter area has been put thru the filter. Such a precoat will be approximately 1/16 inch thich. When this has been accomplished valve V-1 is closed and valve V-2 is opened and the filtration of the dirty solution is carried on. Filter aid

INDUSTRIAL CLEANING MATERIALS

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is mixed in the dirty solution at a rate of about 1 lb. per hundred gallons. Of course the layout shown in this slide is not typical of a plating room set-up, but such an arrangement would be easily made. For instance with our filter press the drip pan beneath the filter can be used as a mixing tank and also for precoating. It is connected to the inlet of the pump and by opening a valve in this line, solution containing filter aid could be bled into the filter.

In order to better visualize what takes place when filter aids are used, we have a slide which is a diagrammatic cross section of a filter cake. This shows the cloth, the precoat and the cake which is a mixture of filter aid and the slimes, metallics and other solids which we wish to eliminate from our plating solutions.

With such modern equipment, and methods at hand no plater should be troubled with rough deposits such as were shown to you tonight in our previous slides. Proper precautions to set up frequent regular filtration cycles or if possible continuous filtration of solutions will lead the way to the elimination of the difficulties encountered in producing thick deposits.

Cleveland Convention Plans Well Under Way

The months of July and August were spent in intensive activity in obtaining data necessary to help mold the decisions of the Convention Committee as to Hotel Headquarters and space for the Exhibits.

The Bridgeport exhibition being such a success, many requests were received for a return engagement at the Cleveland Convention. Many exhibitors had signified their desire to appear and were writing for details.

We felt that there would be no need for entirely new exhibits by such of the firms as had shown at Bridgeport, since the bulk of the visitors at the Cleveland show would be from a new territory and had not been afforded a chance to attend at Bridgeport. The

exhibitors look forward then to a new group to whom they may make known the recent developments in their line.

Care was also given to the selection of exhibit space as near as possible to Convention Headquarters.

WE HAVE GONE FURTHER AND SELECTED A HOTEL IN WHICH WE CAN HOUSE 107 EXHIBITORS IN TWO UNITS WITHOUT CONFLICTING WITH THE USUAL NEEDS OF THE CONVENTION PROCEDURE.

Due to the fact that there will be over thirteen Conventions held in Cleveland next June, the Committee had to act quickly to get a suitable period. The week beginning Monday June 8th was set on as the best offered.

Cleveland is noted as a Convention City, and the Hotel Carter was originally erected to accommodate Conventions. Its physical set up makes it ideal for the combined Convention and Exhibition.

The convention hall will seat 1100 and is fine from the point of acoustics, also it is free from posts and other distracting factors.

The hotel can furnish rooms for a large part of our delegation, no hotel being able to accommodate all unless reservations were made at once. During the Eucharistic Congress and the National Machine Tool Show recently held in Cleveland it was a problem to get hotel rooms unless reservations had been made long in advance.

The Committee plans to keep you posted from month to month as to the progress they are making and hope to be able to show all members that they cannot afford to remain away from Cleveland during the period of the Convention.

Get out that notebook now and mark the period from June 7th through June 12th as reserved for your attendance at Cleveland.

The following Cleveland members are Chairmen of the various Committees:

General Chairman, Henry J. Ter Doest; *Sec.-Treasurer*, Wm. E. O'Berg; *Educational Program*, John S. Nachtman; *Hotels and Reservations*, J. C. Singler; *Registration*, Wm. E. O'Berg; *Publicity*, E. Steen Thompson. *Entertainment*, Wm. D. Scott; *Banquet*, P. Ross Lyons and *Transportation*, R. O. Hull.

The Abstract Section

PATRICK J. SHEEHAN, *Chairman, Program and Educational Committee*

Saving Money on Power Bills—C. G. BACKUS, *Metal Industry*, Nov., 1935.—Although platers fail to realize it, they can very often save money on the electric bill by instituting various economies. The author recommends several procedures:

1. Checking motors and generators to insure that they deliver most of the power energy they receive. He asserts that large motors of good material and workmanship are most economical because the power loss is less than in small motors and in poorly constructed motors. 2. Having bus bars of sufficient size to carry the current without dissipating it in heat engendered by resist nce. 3. The use of rubber racks in preference to bare racks so that only k is plated. And—4. The use of a boiling cleaner to remove heavy grea om work before putting it in an electrolytic cleaner.

V. SHEEHAN.

Influence of Borate Radical on Chromium Hardness—By R. J. PIERSOL, Ph.D. *Metal Cleaning and Finishing*—October, 1935.—Additions of boric acid to chromium plating baths serves several useful functions. The hardness of the plate is materially increased. The chromic acid—sulphate ratio is not nearly so critical. Iron anodes may be used without the usual accumulation of trivalent chromium. It tends to eliminate the characteristic bluish tinge of chromium deposits. A aph shows the resultant degree of hardness with addition of from two to ten grams per liter of boric acid.

E. T. SHEEHAN.

Polishing Cast Iron—By Fred B. JACOBS. *Metal Cleaning and Finishing*—October, 1935.—Despite the porous character of cast iron, proper polishing methods will secure excellent results. Small parts are frequently tumbled with sandstone, carbide of silicon, alumina or emory. For a very high finish the preceding operation may be followed by ball burnishing. Larger flat surfaces may be worked on a horizontal disc grinder. Irregular pieces are usually finished with the conventional polishing wheels. Grit sizes range from No. 24 to a final grease wheel operation, using No. 180 as an abrasive.

E. T. SHEEHAN.

METALS AND ALLOYS—ABSTRACTS

PHIL. J. RITZENTHALER

1. Use of Inhibitors in Preventing Corrosion by Acids. (I) "*Chemical Engineering & Mining Review*" Vol. **27**, May 8, 1935—p. 286.—Inhibitors

are listed as: glue, gelatine, starch, yeast, pyridine, quinoline, naphthalene, sulphonic acid, anthracene oils, glycerine, aldehydes and ketones, sulphite pulp liquor, trithioformate, carbon bisulfide, derivative of reaction product of aldehydes and aquanidine and a thiourea compound, arsenic, antimony, tin chloride and salt. Effectiveness of salt as inhibitor can be shown in describing cause (generally regarded as an adsorption mode of action).

2. Modern Acid Handling Methods Lower Pickling Costs. J. R. HOOVER—"*Wire and Wire Products*"—Vol. **10,** Sept. 1935—p. 407-10.—Improvements have been made in recent years in methods of handling acids in pickling of steel which have resulted in reduction of acid leakage and shut-downs, as well as improved working conditions generally.

3. Baked Finishes on Die Castings.—C. F. SCRIBNER "*Industrial Finishing*"—Vol. **10,** Feb. 1934, p. 39-40.—Difficulties in finishing castings of Al, Zn, Pb or Sn are greatly reduced by a preliminary cleaning by sandblasting or a weak caustic solution at 160°F followed by preheating at 15°—20°F above baking temperature.

4. Use of Inhibitors in Preventing Corrosion by Acids.—*II* V. A. WARDELL "*Chemical Engineering and Mining Review*" Vol. **27,** June 8, 1935, p. 321-3.—A Resume. Weight for weight, arsenic has a much greater inhibiting power than the best organic inhibitors. Inhibitors are adsorbed on the protected surface. Inhibition depends on equilibrium between arsenic deposited on the metal surface and in solution. 25 reference included.

5. Finishing Zinc and Aluminum Die Casting—JOSEPH FOX "*Production Engineering*", Vol. **6**, June 1935, pp. 216-17.—Zinc or aluminum base die casting alloys are best suited for decorative or protective finishing. Lead and tin base alloys are less used when fine finishing is required and magnesium and copper base alloys have not yet been sufficiently developed for such purposes. Finishing consists of chromium plating, particularly of zinc alloys. It may be deposited directly but more often an intermediate metal is used as a base for chrome. For castings exposed to moisture, nickel with minimum thickness of 0.0002″. For more exacting requirements 0.0003″ is used and when appearance is the goal, a coat of 0.0004″ of copper is used, followed by a nickel coat of 0.005″ on which chrome is deposited about 0.00025″. Organic and inorganic finishing lacquers are used which require baking. Aluminum base alloys may be merely polished or finished anodically. All methods require careful cleaning before operations.

6. Copper Plating Aluminum.—"*Machine Design*"—Vol. **7**, May 1935, pp. 21-22.—Notes of recent German process for copper plating on aluminum. Steps are: 1. Polishing with abrasive. 2. Immersion in bath to remove oxide film and also to produce thin copper coat. 3. Rinse in water, rubbing with woolen cloth. 4. Copper plating to any desired thickness.

Business and Social News

BRANCH NEWS

Educational Activities

AMERICAN ELECTRO-PLATERS' SOCIETY

WATERBURY BRANCH

The November meeting of Waterbury Branch A.E.S., was held Friday, evening Nov. 8th, in the Chase Auditorium, Grand Street. A large and representative gathering was present, and included members of the local, Hartford and Bridgeport Branches and workers from various factories interested in the subject of Aluminum.

Ellsworth T. Candee presided at the meeting and introduced the speaker of the evening. Dr. Harold K. Work, Metallurgist of the Aluminum Co. of America, located at New Kensington, Pa. Dr. Work took for his subject, "The Finishing of Aluminum", and interested all present with his talk. The speaker gave some enlightening remarks on the plating of aluminum, calling attention to the practical method of cleaning the metal to be followed in most cases by a surface roughening in acid, rinsed in cold water and hung in the solution. Attention was called to the Aluminum alloys which are used to the greatest advantage in the plating of the metal. Stress was laid on the fact that the etching of aluminum before plating was most important.

Leaving the subject of plating, the speaker spent most of his time telling of the various finishes on aluminum articles one notes every day, from bracelets to electric washing machines.

The anodizing, coloring and matte finishes as well as many others were explained and proved very interesting. A number of samples were passed around, many of them having two or more colors, and they helped greatly to illustrate the points being spoken of by the speaker. At the conclusion of his remarks Dr. Work answered many questions, after which a rising vote of thanks was extended the speaker. Whilst in the city, Dr. Work met many of his friends who unite with members of the local Branch in thanking the speaker and the Aluminum Co. for an entertaining and educational evening.

Communication was received from 2nd Vice-Pres., P. J. Sheehan, chairman of the Program and Educational Committee, stating that Mr. E. H. Tingley would write a series of six articles, on questions pertinent to A.E.S. members.

Favorable action was taken on the applications of George C. Heinrich and Alois Huber. Application for associate membership was received from George C. Muscio of the Lea Mfg. Co.

Announcement was made that the next meeting of the Branch would take place Friday evening, Dec. 13th, and the speaker would be William S. (Cyanide Bill) Schneider. "Bill's" subject will be "Brass Plating", and his audience can depend upon hearing an interesting discourse on same.

WM. F. GUILFOILE, *Secy.*

DETROIT BRANCH

A regular meeting of the American Electro-Platers' Society, Detroit Branch, was held on Friday evening, November 1st, 1935, at 8.00 o'clock, at the Hotel Statler. President W. W. McCord presided. A very good attendance were present. Minutes of the

previous meeting were read and approved.

The applications of Mr. John A. Maguire, Associate, 10-522 Gen. Motors Bld., Detroit and Mr. Jas. Wm. Higgins, Active, Packard Motor Car Co., Detroit were reported favorably by the Board of Managers, and they were unanimously elected to membership in our Society.

Then followed a tri-cornered debate on the proper sequence of plating steel parts. Mr. John McCullough had 12 minutes to speak on the sequence of nickle, copper, nickle; Mr. A. B. Wilson followed with 12 minutes on the sequence of cyanide copper, nickle; Mr. B. F. Lewis closed with 15 minutes on the sequence of cyanide copper, acid copper, nickle. Then followed the rebuttal. Mr. Wilson had 3 minutes and Mr. McCullough had 3 minutes.

This was something out of the ordinary and was put on for a test to see what the debate would bring out, and it was very interesting. It brought out quite a lot of discussion and every phase of the nickle situation at present and past were brought up and discussed. We are to have more of these debates later on other phases of plating.

The gentlemen who took part in these debates are to be congratulated on the way they treated their particular parts of it, inasmuch as two of them who had these subjects did not really believe in the sequences on which they had to talk.

We are looking forward to future meetings when we will have more of these and any one belonging to the Society who does not attend these meetings is missing a lot. As none of the proponents of this debate had any written papers, I am unable to send these in for publication.

The meeting adjourned at 10.30 P. M. T. C. EICHSTAEDT, *Secy-Treas.*

CHICAGO BRANCH

The regular monthly meeting of Chicago Branch was held Saturday, November 9, 1935.

President F. Herbst presided and all other officers were present. Mr. H. A. Gilbertson, chairman of the Banquet Committee, reported that all plans for our 24th Annual Banquet on January 18, 1936, were nearly complete.

Mr. J. McCarthy was reinstated, Mr. T. H. Dobson was elected an active member of Chicago Branch.

An application was received from Mr. F. L. Ruder and a committee appointed on same.

Mr. F. Romanoff and Mr. H. Gillis, both of whom are on the sick list, are reported to be improving and it is hoped that they will soon be back among us.

Mr. C. Clindinin gave a very interesting talk on Electrical Contacts and Solution Resistance.

Mr. O. E. Servis, the Librarian, found the following questions in the question box:

No. 1. *Is it practicable to chrome plate directly on yellow* 85, 15 *brass castings with any success?*

Ans. It can be done but is not recommended as it corrodes more rapidly and does not wear as well as when Nickel plated before Chrome plating.

No. 2. *How is brass stampings ball burnished before and after Nickel Plating?*

Ans. Burnish with Steel Balls with a Neutral Soap Solution both before and after Nickel Plating.

No. 3. *How can tinned sheet iron be nickel plated and chrome plated without peeling?*

Ans. Clean in a mild cleaning solution and plate in a nickel solution same as used in plating die castings.

J. W. HANLON, *Sec.*

LOS ANGELES BRANCH

Minutes of the Los Angeles Branch A.E.S. held at the Roslyn Hotel. Vice-Pres. E. R. Williams presided.

Minutes and financial report of the previous meeting were read and accepted.

Our president, Bob Gripp, sent word that due to his business obligations he would be unable to attend the meetings for some time and asked to be released from office. The members voted to declare the President's office vacant. The Vice-president, E. R. Williams was elevated to the President's office and John L. Merigold was elected vice-president.

The question of a bond for the Sec-Treas. was discussed. This bond had been dispensed with for the last four years as an economy measure. The members decided this was not a good precedent to establish and the secretary was instructed to take out a bond for $1000.00.

Mr. Merigold acted as librarian. The following questions were brought out:

Q. What is best anode for silver?

A. 999 point fine silver, annealed.

Q. When an acid copper plate streaks what is the cause?

A. No definite answer. Suggested that anodes be hung on the work rod and solution worked hard.

Q. How can a metal made of 75% tin and 25% lead be cleaned for plating?

A. Cleaner made of 4 oz. trisodium phosphate per gal. Use direct current.

Q. Give formula for bright dip for aluminum.

A. Sulphuric acid 2 parts, Nitric acid one part. Add a little muriatic acid or sodium chloride.

Q. Which is best dip for metal before nickel plating, cyanide or acid dip?

A. Some members favored each kind.

EARL COFFIN, *Sec-Treas.*

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ANDERSON BRANCH

The Anderson Branch of the A. E. S. held their November business meeting Monday evening, November 25th, at the home of Mr. Castell, our President.

The officers all being present, we proceded to formulate plans for our December meeting which is to take the form of a party to be held at the "Guide Lamp Shack." This party is planned as a welcome to our new members, whose applications have been accepted.

Anderson Branch expects to announce in the minutes of the December meeting a membership gain of 40%.

The speaker for our party meeting will be Mr. John Taylor of Marion, Indiana.

After a report from our treasurer we adjourned at 9:30 P. M.

JAMES W. MINTON, *Sec.*

BRIDGEPORT BRANCH

The regular November meeting of the Bridgeport Branch was held on Friday, November 1st. There were thirty-five members present.

Tom Chamberlain gave the final report for the 1935 Convention Committee. The report was accepted and the committee was tendered a vote of thanks by the Branch.

A motion was made and seconded that the Bridgeport Branch hold a Spring Banquet and Educational Session in the early spring, the date to be determined later. The motion was carried and Joe Sexton will be general chairman in charge of the affair.

A motion was passed to have no Program Committee other than the Librarian of the Branch, Mr. Walter Meyer.

Motions were made and passed that the Branch make the following donations—

To present $250.00 to the Supreme Society;

To present $300.00 to the Research Fund of the A.E.S.;

To present $200.00 to Tom Chamberlain for the work he did as Secretary-Treasurer of the Convention Committee.

The following committee was appointed to arrange for appropriate presentations to the members of the Convention Committee, made up of the chairmen of the various subcommittees—George Wagstaff, Wm. Flaherty, Fred Lancaster, and Wm. Stratton.

After a question box conducted by Walter Meyer the meeting adjourned.

CHARLES H. COSTELLO, *Sec.*

CLEVELAND BRANCH

The following is a copy of the regular, monthly meeting of the American Electro-Platers' Society which was held at Hotel Carter, November 2, 1935.

The meeting was called to order by our President, Mr. W. D. Scott, at 8:15 p.m. The minutes of the October meeting were approved as read.

An application for active membership was made by Mr. Carlson of the American Tinning & Galvanizing Company, Erie, Pa., was turned over to our Board of Managers. Mr. Anger of The Udylite Process Company was balloted on and was elected by an overwhelming vote. The secretary was instructed to notify him of his election.

The death of one of our fellow members, Mr. H. E. Button, of 2027 Wyandotte Avenue, Lakewood, was reported with deep regrets.

Mr. Singler, chairman of The Hotels & Reservations Committee reported that Hotel Carter would be Convention Headquarters, and would house the exhibitions. Mr. Hull of the Transportation Committee reported progress.

A letter from Mr. P. J. Sheehan, chairman of The Educational Committee of the Parent Body was read. Our President then told our Librarian to watch for these papers and bring them up at our meetings for discussion.

There being no further business of importance a motion was made to adjourn and join the ladies who were invited to come and help us arrange a program for the entertainment of the Ladies at the Convention.

WILLIAM O'BERG, *Sec.-Treas.*

MILWAUKEE BRANCH

Milwaukee branch A.E.S. regular meeting was held at Lipp's Hall corner N. 3rd & W. Highland Ave., Nov. 14, 1935. President Bob Steuernagel presiding. All officers were present but one of our Board of Managers. Henry Binder, who is in the hospital re-

cuperating from an accident to his hands. We wish him well. Business of the evening was run through as quickly as possible,—being a booster night. The interest shown at this meeting was more than the committee had bargained for with close to sixty men present.

Two applications for membership, Mr. Melvin E. Lutzke and Mr. Florian Bertling were accepted.

Mr. Pat Sheehan gave us his version of the new educational program appearing in the MONTHLY REVIEW, shortly.

Mr. Dan Wittig did very well on the membership committee. It has been definitely decided to have a smoker, to be held sometime in the early spring.

We had four members from Chicago branch present. Mr. Stenberg, Past President, Chicago who gave us a talk. Mr. William Meggers, Mr. Jacob Hay and Mr. Charles Berry. One of the features of the evening was an interesting demonstration of the microscope by Mr. William Geissman showing samples of work to be measured, the polishing materials used, along with some interesting pictures he had taken of cross sections of plated metals.

The grand finale of the evening was the excellent refreshments that topped off a real booster meeting.

R. C. BINDER, *Sec.-Treas.*

BALTIMORE-WASHINGTON BRANCH

The regular monthly meeting of the Baltimore-Washington Branch was held at the Bureau of Standards, Saturday November 2nd. After a short business session, during which it was decided to hold the Annual Meeting and Banquet in Washington on February 1st, the meeting was turned over to Mr. Strausser, our librarian, who introduced Dr. Kasper who spoke on "The Mechanics of Chromium Plating." Mr. Brenner then abstracted a paper by Mr. Candee on "The Effect of Various Acids on Steel."

IRVIN H. HAHN, *Sec.*

NEW YORK BRANCH

Report of New York Branch A. E. S.

A regular meeting of New York Branch was held on Nov. 8. The members were sorry to hear of the illness of our president John Rolff. It is our sincere hope that the time will be short till John is with us again. An interesting communication was read from Arthur Grinham in far off Australia. Mr. Grinham is to be admired for the contacts he keeps with his old friends and brother members.

Joseph Tresca an old time member was reinstated and welcomed back. Bill Voss was present at this meeting and up to his old tricks again, dropping a bomb shell and doing a disappearing act. You can be assured of a lively meeting when he's present. Our second meeting was held on Nov. 22.

Mr. Messano was reinstated after an absence of a few years. It sure is a good sign when these old members are returning.

In the absence of Librarian Englander, Mr. Lionel Cinnamon acted in his place, and conducted a very interesting Good and Welfare session.

The main topic of discussion was gold plating and methods which brought forth some very enlightening data. Our librarian is arranging to have some interesting speakers during the winter season which we expect to be very active.

ARTHUR WALLACE,
Recording Secretary.

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PHILADELPHIA BRANCH

Phila. Branch held its regular meeting on Nov. 15th with President Al. Hirsch presiding. Phila. Branch has put its shoulder to the wheel as has been shown by the large attendance at all its regular meetings this season. Pres. Al. Hirsch is delivering a series of lectures that are of interest to all foreman platers and the same are being appreciated by the prompt and early attendance of our members, being present at 7.30 P. M. to hear these lectures.

At 8 P. M. we have our guest speaker and here again we have been very fortunate in having such men as Dr. A. K. Graham and Dr. E. B. Sanigar as speakers, and at this time the branch officers want to thank the members for their support in attending the meetings regularly. At our last meeting Pres. Hirsch gave a talk and demonstration on the "Determination of Cathode Efficiency" with a copper coulometer. Details were also given so that a plater can set up one of these in his plating department. These talks are becoming so interesting that we may have to allow more time to these subjects for discussion. Dr. A. K. Graham then gave a talk on Zinc Plating with the mercury-aluminum-zinc alloy anodes, and this being a timely topic due to the need of bright zinc plating, was highly appreciated as shown by the discussion which followed.

At the business session which followed one application was received for active membership, two new active members were elected, and two active members were reinstated.

On Saturday, Nov. 23rd Phila. Branch held its Yearly Meeting and Banquet and the same was so well attended, it really looked like a National Convention with so many of our friends from the Newark, Baltimore-Washington, New York and Waterbury Branches present. Supreme Pres. Tom. Slattery and five Past Presidents,—Philip Sievering, Philip Uhl, Frank Mesle, Horace Smith and George Gehling were there to add dignity to the occasion. The speakers, all well known throughout the American Electro-Platers' Society, were all that could be desired as the program proved. "The position of the Practical Plater in Modern Industry" by Mr. Ralph Atkins, of the Phila. Branch, Foreman Plater at the Atwater Kent Mfg. Co., was well set up, and showed that to be a practical foreman plater, he must possess more than a chemical knowledge of his solutions.

"Etching Process for Name Plates and Dials" by Mr. Harry Shelly of the Phila. Branch and foreman Plater, U. S. Gauge Co., was a very good paper and many exhibits were shown and explained. Mr. Shelly deserves great credit for the able manner in which he presented this paper.

"The Chromium Plating Solution Controversy and the Fink Patent" was written by Mr. Chas. H. Proctor, Founder of the A. E. S., but Mr. Proctor, due to ill health was unable to attend and Past Pres. Philip Sievering read this paper. Everyone present was disappointed because of Mr. Proctor's absence, as we all expected some lively discussions on this paper.

"Measuring The Thickness of Electrodeposits of Silver Plated Tableware" by Mr. Frank G. Mesle, Past President, A. E. S. and Foreman Plater, Oneida, Ltd. Oneida, N. Y., was also a very interesting paper and showed the possibilities that may be obtained.

"Applications of Mesle's 'Chord' Method for Measuring the Thickness of Electrodeposits" by Dr. William Blum, U. S. Bureau of Standards, Washington, D. C. Everyone knows when Dr. Blum gets up there is going to be something worth while, and this time was no exception for Dr. Blum gave us all something to think about.

"Solvent Degreasing and Metal Cleaning in Modern Electroplating Practice" was given by Mr. M. Marean, E. I. Du Pont de Nemours & Co. Wilmington, Del. This being something different from all previous proceedures in cleaning, it was well received by all.

"Pictorial Study of Plating Solutions" by Mr. W. M. Phillips, Research Engineer, General Motors Corp. Detroit, Mich., was something all our members have been waiting to see, and our friend Phillips and his assistants sure gave them a treat long to be remembered. Mr. Phillips was complimented on the fine showing he made and we hope to see him again in Phila.

Phila. Branch at this meeting started a new innovation, the branch giving prizes to the Phila. active members for papers presented at this meeting and also for the best exhibits of finishes displayed. Mr. Harry Shelly, Mr. Ralph Atkins, Mr. N. Verrelle and Mr. John Himes are to be congratulated on their success in getting these prizes, and we hope next year we will still have a larger list of prize winners. Mr. Philip Uhl, Mr. Otto Mott, Mr. Howard Strunk, Mr. James T. Mac Evoy and Mr. George Gehling were each given a souvenir of the meeting, all having put in over 50 years of continuous plating service. This brought forth something unexpected, as there were quite a few members of other branches present, who also had seen over 50 years service and it was suggested that a time and place ought to be set aside each year, possibly at our convention, to have these members get together and discuss over past and present conditions.

The Banquet was a swell success and every one enjoyed the eats, music, talent and the dancing and so another Yearly Meeting and Banquet of the Phila. Branch passes off into history.

R. E. JACKSON, *Librarian.*

SPRINGFIELD BRANCH

A meeting of the Springfield Branch A. E. S. was held Nov. 12, 1935 at the Indian Social Club Rooms. There were 31 members present. The minutes of the previous meeting were read and approved. There was no business meeting.

The speaker of the evening was Mr. C. G. Rising, Supt. of the National Blank Book Co. of Holyoke. His topic was "The Management Side of the Plating Room." He also exhibited some very interesting samples of aluminum, anodic treated and colored. After answering questions from various members, the meeting was adjourned at 10.30 P. M.

H. DELARME, *Sec.*

A meeting of the Springfield Branch A. E. S. was held Nov. 25, 1935 at the Indian Social Club Room. Vice President McCarty was in the chair. There were 19 members present. There was no business meeting.

The Speaker of the evening was Mr. H. O. Hull of the Grasselli Chemical Co. of Cleveland. His subject was "The Alkaline Cyanide Zinc Process, or Bright Zinc Plating." He outlined the chemical contents of this bath and

its control. Some interesting samples of bright zinc plating on various articles were distributed to the class, and he also demonstrated the Strausser strip test for thickness of zinc deposit. This test consists of droping a stripping solution at 100 drops per minute on a plated article. The time is taken and the thickness determined. After answering various questions by the class, he was given a rising vote of thanks.

The meeting was adjourned at 9.50 P. M.

H. DELARME, *Sec.*

ROCHESTER BRANCH

The regular monthly meeting of the Rochester Branch was held at the Seneca Hotel on Friday night, Nov. 15. As it was an open meeting all business was laid over until after the speaker of the evening was through, Mr. Kohlmeier then introduced the guest speaker Mr. Gust Sodenburg, representative of the Udylite Company, whose subject was "Changing from Cadmium Plating to Bright Zinc Plating." In his talk he stressed the point of the necessity of some other plate to take the place of Cadmium because of the scarcity and high cost of Cadmium, and said that there was no reason why a Bright Zinc could not be used inasmuch as the difference between the resistance to corrosion of Cadmium and Zinc was almost negligible. After his talk there were many questions which Mr. Sodenburg very gladly answered and then a rising vote of thanks was tendered Mr. Sodenburg by his listeners.

After the talk the regular business meeting was called to order by Pres. Kohlmeier. The application of Daniel Martin Kennedy, as Associate Member, 81 Thurston Rd., Rochester, N. Y. was read and ordered published. After a little more business meeting, was adjourned.

JUDSON R. ELSTER, *Sec'y.*

BOSTON BRANCH

Boston Branch met in an open meeting at the Hotel Manger, Boston, Nov. 21st at 8 P. M. with Pres. Don Wood in the chair.

The regular order of business was suspensed with as we had as the speaker of the evening, Mr. George B. Hogaboom.

Before introducing the speaker the Pres. give a little talk on the coming banquet to be held on Feb. 29, 1936 and asked the support of all those present to make it a great success.

President Wood then introduced Mr. George B. Hogaboom who gave an instructive talk on "The Protective Coatings for Metals." The present cadmium situation was discussed. It was brought out that the shortage of cadmium had accelerated development of bright zinc plating. This is now an accomplished process and several solutions are being offered the trade.

Mr. John Harney, Old Colony Plating Company, Boston, exhibited several samples plated in Hanson Van Winkle Munning's "Magic" solution. The samples brought out many favorable comments.

Several questions were answered by the speaker and the meeting was considered one of the best held. The promise was made to bring more speakers, who had a story of interest to tell and all present were requested to give their name to the Secretary so that notices of these meetings could be sent them.

A. W. GARRETT, *Secy.*

HARTFORD BRANCH

The Hartford Branch of the A. E. S. held their regular meeting on Monday evening November 18, 1935, at the Hartford State Trade School, 110 Washington St., Hartford, Conn.

The meeting came to order at 8:15 P.M., with the President St. Pierre in the Chair. Minutes of the previous meeting were read and accepted. All communications were read and placed on file. All bills were turned over to the Executive Committee for disposal.

Mr. Walter Meyer was the speaker for the evening, and gave one of the finest talks, accompanied with slides, that we have had in a long time.

His lecture was on "Films in Deposition." The talk covered the many types of films encountered by the plater during the deposition of metals, their cause and the usual methods of removing them. The talk as well as the discussion which followed was thoroughly enjoyed by the twenty-one members who were present.

In conclusion, Mr. Meyer, who is an Engineer for the General Electric Co., of Bridgeport, Conn., was given a rising vote of thanks for his very fine talk.

The meeting was adjourned at 10:15 P.M.

V. E. GRANT, *Sec'y.*

Memorandum

Conference with A. S. T. M. on Plating Specifications, Philadelphia, November 23, 1935.

On November 23rd, 1935, T. F. Slattery, W. M. Phillips and W. Blum conferred with C. L. Warwick and R. E. Hess at the A. S. T. M. office in Philadelphia, regarding the best procedure for publishing and distributing the specifications recently adopted by the A. S. T. M. and A. E. S.

As it is customary for the A. S. T. M. to print such specifications for sale, it seems preferable to have them printed by the A. S. T. M. as "Joint Specifications of the A. S. T. M. and A. E. S." in one pamphlet, bearing the seals of both organizations. The A. S. T. M. agreed to furnish 1000 copies free for the use of the A. E. S. Research Committee, and as many more copies as are ordered by the A. E. S., at the net cost of printing, which will be about $25 per thousand.

Copies will then be on sale by both organizations at the following scale of prices, which is now used by the A. S. T. M.:

1 to 9 copies	Price per copy	$0.25
10 to 24 "	"	.20
25 to 99 "	"	.175
100 to 249 "	"	.15
250 to 499 "	"	.125
500 to 999 "	"	.10
1000 or more "	"	.075

It was tentatively agreed that the A. S. T. M. will at once print 5000 copies, of which 1000 will be furnished free to the A. E. S., and 1000 will be purchased by the A. E. S. at cost. The profits from the sale of the specifications will be retained by the organization by which they are sold.

The net effect of this plan is to reduce any obligation of the A. E. S. for such printing from about $200 to $25, while still leaving the to A. E. S. any profit made on the copies sold by them.

It was suggested that a notice be published in the REVIEW that copies can be purchased at the above prices from Mr. Kennedy, and that any profits will be applied to the Research Fund.

T. F. SLATTERY.

Membership Report

To November 18, 1935

ELECTED

A. E. Cummings, 8½ Bond St., Oshawa, Ontario, Canada
Active, Toronto Branch

J. A. Martin, 160 Oak St., Toronto, Ontario, Canada
Active, Toronto Branch

F. B. Gotthardt Associate, Bridgeport Branch

T. H. Dobson, 766 S. Lee St., DesPlaines, Ill.
Active, Chicago Branch

Alois Huber, c/o Manning-Bowman Co., Meriden, Conn.
Active, Waterbury Branch

George C. Henrich, c/o Manning-Bowman Co., Meriden, Conn.
Associate, Waterbury Branch

John Mullins, 25 E. Fornace St., Norristown, Pa.
Active, Philadelphia Branch

John W. Himes, Bustleton Ave., Somerton, Philadelphia, Pa.
Active, Philadelphia Branch

APPLICATIONS

Joseph Sullivan, New Haven Clock Co.
Associate, Bridgeport Branch

Frederic M. Carlson, American Tinning & Galvanizing Co., Erie, Pa. Active, Cleveland Branch

F. L. Ruder, 7007 Sheridan Road, Chicago, Ill.
Active, Chicago Branch

Melvin E. Lutzke, 2795 S. Ellen St., Milwaukee, Wisc.
Associate, Milwaukee Branch

Florian Bertling, 2009 S. 11th St., Milwaukee, Wisc.
Associate, Milwaukee Branch

O. W. Tomlinson, 640 14th St., N. E., Washington, D. C.
Active, Washington Branch

Lancaster Lowry, Metal Testing Division, Washington Navy Yard, Washington, D. C. Active, Washington Branch

Wm. P. Scherrer, 103 Kingston Ave, Capital Hghts., Md.
Active, Washington Branch

Dr. Chas. Kasper, Bureau of Standards, Washington, D. C.
Active, Washington Branch

George C. Muscio, 16 Cherry Ave., Waterbury, Conn.
Associate, Waterybury Branch

Daniel Martin Kennedy, 81 Thurston Road, Rochester, N. Y.
Associate, Rochester Branch

Dwight Overcash, 1327 Arrow Ave., Anderson, Ind.
Associate, Anderson Branch

Geo. Lowther, 2401 Arrow Ave., Anderson, Ind.
Associate, Anderson Branch

Ed. McKinney, Nichol Avenue, Anderson, Ind.
Associate, Anderson Branch

E. McGuire, 1522 West 8th St., Anderson, Ind.
Associate, Anderson Branch

R. Phillips, 406 Pendleton Ave., Anderson, Ind.
Associate, Anderson Branch

T. Castor, 1718 Louise St., Anderson, Ind.
Associate, Anderson Branch

L. Hinch, 407 Louise St., Anderson, Ind.
Associate, Anderson, Branch

E. Kirkham, Edgewood Addition, Anderson, Ind.
Associate, Anderson Branch

R. Kurtz, Guide Lamp Corp., Anderson, Ind.
Associate, Anderson Branch

Joseph Godfrey Grey, 6204 Hasbrook St., Philadelphia, Pa.
Active, Philadelphia Branch

John Binns, 1524 Wisconsin Ave., Washington, D. C.
Active, Washington Branch

Christopher M. Keller, 1124 Morse St. N. E., Washington, D. C.
Active, Washington Branch

Wm. Robert Davis, Seat Pleasant, Md.
Active, Washington Branch

H. Bird, 58 Lacy Ave., Toronto, Ont. Toronto Branch

J. McLean, 4 Ottawa Ave., Toronto, Ont. Toronto Branch

H. Hands, 266 Mortimer Ave., Toronto, Ont.
Toronto Branch

F. Euscott, 177 Westlake Ave, Toronto, Ont.
Toronto Branch

DIED

H. E. Button, 2027 Wyndotte Avenue, Lakewood, Ohio
Cleveland Branch

REINSTATED

J. Welsby, 75 Graham Ave., South, Hamilton, Ont.
Active, Toronto Branch

S. J. Pearce, Box 586, Port Hope, Ont.
Active, Toronto Branch

J. McCarty, 3514 N. Overhill Ave., Chicago, Ill.
Active, Chicago Branch

Joseph Moyer, 724 Thorn St., Reading, Pa.
Active, Philadelphia Branch

John Yingling, 32 Walnut St., Natick, Mass.
Associate, Philadelphia Branch

M. Robinson, Toronto Ont. Toronto Branch

SUSPENDED

Carmine Caruso, Waterbury, Conn.	Bridgeport Branch
Wm. Peters, Middletwon, Conn.	Bridgeport Branch
L. A. Theriault, East Norwalk, Conn.	Bridgeport Branch
Salvatore Zanelli, Bridgeport, Conn.	Bridgeport Branch
Charles Walsh, Naugatuck, Conn.	Bridgeport Branch

TRANSFERRED

John B. Dickson, Chicopee, Mass., from Hartford Branch to Springfield Branch

John Yingling, 32 Walnut St., Natick, Mass., Associate, Philadelphia Branch to Bridgeport Branch

RESIGNED

Al. Phelps, Saginaw, Mich., Anderson Branch

NOTICE

Papers for the Educational Sessions A. E. S. 1936 Convention must be received before April 1, 1936.

J. S. NACHTMAN
Chairman Educational Committee
427 Central Parkway
Warren, Ohio

To the Officers and Members of the A. E. S.

The second of Mr. Tingley's articles which is appearing in this issue of the MONTHLY REVIEW is worth the time you spend studying it. It deals with one of the fundamental elements of success, namely, "The Open Mind."

When you read and study this article of Mr. Tingley's, put yourself in the position of being quizzed by the writer. Answer his questions to yourself; see where you stand. Determine to practice the things he writes about. Acquire an open mind, and decide to keep it open, for in this way you will be building a successful character on a solid foundation.

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Membership Drive Barometer

Branch	Elected	Reinstated
Philadelphia	6	2
Toronto	2	3
Bridgeport	2	
Pittsburgh	2	
Waterbury	2	
Los Angeles	1	1
Toledo	1	
Chicago	1	1
Balto-Washington		
Newark		
Cincinnati		
Milwaukee		
Hartford		2
New York		
Rochester		
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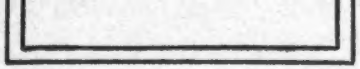

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